RAILROAD GAZETTE

FRIDAY, MAY 31, 1878.

Tests of Passenger Locomotives on the Chillan & Talcahuano Railroad.

[A paper by John E. Martin, Master Mechanic of the Chillan & Talcahuano Railroad, contributed to the Committee on Locomotive Tests of the Master Mechanics' Association, and submitted with their report at the convention in Richmond, Va., May 16, 1878.]

CONCEPCION, Chile, S. A., March, 1878.

To the Committee of Locomotive Tests, Master Mechanics' Association:

GENTLEMEN: I propose writing in the following paper the result of observations and experiments made on the passenger engines of this railway, and wish to show, by the aid of the indicator, what is the most proper arrangement of the details governing the economical distribution of the steam used in doing their daily work.

Most, if not all the articles on the subject of "locomotive economy," that I have seen lately have reference to the evaporation duty of the coal and the contrivances that will increase the number of pounds of water evaporated per pound of fuel.

Now the economical use of the steam is a subject deserving of as much attention as the coal, especially where the water is impure, and where the cost of supplying it is great, as is the case on some railways on this coast.

To work steam with the greatest economy we must use high pressures and cut-off at a small fraction of the stroke.

What is the highest pressure recommended, and what is the smallest practicable cut-off for every-day work on a locomotive?

These questions will be answered differently, according to the character of the road, train and proportions of valve gearing.

If each master mechanic would write his experience of the subject a most valuable book would be compiled, which might be called "The Greatest Expansive Duty of Steam in the Locomotive."

EXPERIMENTS ON NO. 9 PASSENGER ENGINE.

The highest pressure used on this road on passenger locomotives is 130 lbs.

Our smallest practicable cut-off is 4½ in., which we call the first notch from the centre or midgear.

Since the passenger engines have been successfully worked in this notch for the past two years, I propose confining myself to a description of the work that can be done with a boiler pressure of 130 lbs., and cutting off the steam at so small a fraction of the stroke.

These engines have been run with an admission less than 4½ in., but the valve and valve seats soon gave trouble.

Road.—A section of this road was sent to the Association last year, the maximum grade being 1 per cent., the difference in level between the highest and lowest points 394 feet. The curves number about 200, the shortest being 1,000 feet radius.

Train.—The train consists of four cars, two being passenger, one baggage and one stock car; total weight, including engine and tender, 200,000 lbs.

The engine and train are described more in detail in accompanying sheet of fuel experiments.

The engine had cylinders 15×24 in., of "American" class, having driving wheels 5 ft. 5 in. diameter.

Although papers written on each notch would contain some details common to all, I will confine my remarks exclusively to the first notch or 4½ in. cut-off, because I think I can prove my assertions.

The experiments were carried out with the greatest care, and every reliance may be placed on them.

The indicator cards were all taken with the same indicator and with the same spring, and no alterations of any kind were made to the engine, with the exception of those stated.

The indicator is an excellent instrument, and it has invariably guaranteed its work by describing the figure several times. The only fault that can be found—if such it is—is that the piston is a trifle easy in the cylinder, and if this should be the cause of any slight error, it has been repeated in every experiment.

The steam gauge is *correct*, and the amount of water in the boiler when each card was taken, is carefully noted on its face.

The revolutions were counted with a stop-watch, and are as nearly correct as it is possible to have them by these means.

Cards.—The clearance in cubic inches between the valve and piston, when at the termination of its stroke, is indicated by a line drawn at right angles to the atmospheric line. The line of perfect vacuum is drawn at 14½ lbs. below the atmospheric line, and parallel with it another is drawn to indicate the boiler pressure.

The theoretical curve of expansion is drawn from a point in the expansion line a little before the port opens to the exhaust, and in nearly every case at $\frac{6}{10}$ of the stroke.

An example of the mode employed in calculating the amount of water used and the horse-power developed by the locomotive is given below:

FIGURE NO. 22—FRONT END.

Area of piston	176.7 sq. in.
Stroke of "	24 in.
Cubic inches of clearance	360
Revolutions per minute	144
6-10 of stroke (point at which steam used is measured)	14.4 in.
3-10 " " saved	7.2 "
Steam pressure, measured from vacuum line, at 6-10 of stroke	42.25 lbs.
Steam pressure, measured from vacuum line, at 3-10 of stroke	24.5 "

$$\frac{176.7 \times 14.4 + 360}{1{,}728} = 1.681 \text{ cub. feet.}$$

Weight of a cub. foot.

$1681 \times (42.25 = 0.1025) = 1{,}721$ gross lbs. of steam used per stroke.

$$\frac{176.7 \times 7.2 + 360}{1{,}728} = 0.945 \text{ cub. foot.}$$

Weight of a cub. foot.

$0.945 \times (24.5 = 0.0613) = 0.0579$ lb. of steam saved by compression.

$0.1721 - 0.0579 = 0.1142$, actual consumption of steam per stroke.

$0.1142 \times 144 \times 4 = 66$ lbs. of steam, or water, used per minute.

$66 \times 60 = 3960$ lbs. of water used per hour.

Gross pressure	47.5 lbs.
Back "	11.3 "
Mean	36.2 "

$$\frac{176.7 \times 144 \times 4}{33{,}000} = 3.084 \text{ H. P. per lb. of steam.}$$

$3.084 \times 36.2 = 111.64$ H. P. for one cylinder.

$111.64 \times 2 = 223.28$ H. P. for both cylinders.

$$\frac{3{,}960}{223.28} = 17.73 \text{ lbs. of water per H. P. per hour.}$$

The points up to which steam is measured are carefully marked on the figures, and with little trouble all the calculations can be checked.

Another advantage gained by carefully marking these points with the corresponding pressure is to prove that no partiality has been shown to obtain particular results.

A variation of one pound in pressure at the point where the steam is measured makes a difference of about 5 per cent. in the result of the calculations to obtain amount of water used for horse-power.

By drawing the theoretical expansion curve through this point—and this has been done in nearly every case—we can check its correctness; in fact, there is no other mode of proving its position.

Although all the calculations have been made from the original cards, they should be repeated on the tracing with equal results—a proof of the correctness of the copy.

If the committee should advise the printing of these cards, I would recommend that they be printed full size and with the above lines and points carefully marked, as shown, and any master mechanic who may have leisure could go over the calculations, and some better and perhaps more simple mode of calculating them be introduced.

In these cards may be profitably studied the effect of lap, lead, piston clearance, size of steam-port and size of exhaust nozzles.

Experiment No. 1.—The first experiment, made May 25, 1878, was for the purpose of testing the method of setting the slide valves.

Cards Nos. 1, 2, 3 and 4 were taken, and show an excellent distribution of the steam.

The clearance between the piston (when at the end of its stroke) and the cylinder head being $\frac{7}{16}$ in., to this must be added the area of an annular space in the cylinder head. The cubic contents of this clearance space, together with that of the steam passage, are 325½ in., or an amount equal to 0.076 of the cubic contents of the cylinder.

The lap of the valve is $1\frac{1}{16}$ in. The lap on the front edge is about $\frac{1}{32}$ in. less than this, having been cut to obtain a correct diagram. It is unnecessary to state that the better way would have been to lengthen the eccentric rod. The lap has not been altered in any of the experiments.

Card No. 1 is introduced to show to what an extent compression is increased by cutting off at points less than 4½ in.

In the first notch the valve only opens $\frac{1}{32}$ in. more than the amount due to lead, or in fact nothing more than the lead owing to slack, or lost motion, and in the centre notch or mid gear the valve does not open more than the lead. Although the difference in the amount of port opened by the valve in these notches is so slight, the results, as shown by the indicator, are very different.

In the centre notch the back pressure is 41 per cent. of the gross pressure, and this with a power of only 122 horses, while the H. P. developed under similar conditions of speed and boiler pressure in the first notch is 208, and the relation of back to gross pressure very much less, being only 23 per cent.

The consumption of steam per indicated H. P. per hour is about 5 per cent. less in the centre, a result due to the very expansive use of the steam, it being expanded down to 15 lbs. above the atmosphere at the point of release. This fact must be kept in mind in comparing any of the cards, namely, that when the steam is very much expanded by any arrangement less power will be developed and consequently there should be less water used per indicated H. P. It then follows that the best card is that which shows a greater power with an equal or less quantity of water used per hour.

Again, I find that 160 revolutions per minute, or about 32 miles per hour, is the most economical speed; that is, the water used per H. P. per hour at that speed is less than when the engine is running at a higher or lower speed. This result depends greatly on the amount of lead; with a large amount of lead, say ¼ in., a greater speed than this is attained with less economy than with a small amount, say ⅛ of an inch.

The effect of initial pressure is also very marked; the higher the pressure the better the result. This depends not only on the advantage to be gained in power by the use of higher pressure steam, but that the distribution is better: first, the admission line is kept straighter, the boiler pressure more nearly attained, and as back pressure is almost entirely made up by compression—an almost constant amount independent of a small variation of initial pressure—the proportion of back to gross pressure is lessened.

The advantage, therefore, of one or two pounds greater pressure is quite marked; especially is this the case with a small amount of lead.

The effect of lead is very important, and a slight excess or decrease of lead has a remarkable effect on the economical distribution of steam in this notch. To move the eccentric rod $\frac{1}{64}$ of an inch is accompanied by a slightly different card, and it is very difficult, if not impossible, to accurately distribute the steam in the cylinder by the ordinary shop method of setting the valves—a difficulty much increased by slack or lost motion. The only correct way is by the use of the indicator.

Experiment No. 2.—The clearance spaces between the piston and cylinder head were reduced to somewhat less than $\frac{7}{8}$ in. by facing off the cylinder heads and riveting to them wrought-iron plates ⅝ in. thick.

Nos. 5, 6, 7 and 8 are cards taken with this alteration.

The effect of this reduction of clearance is:

1st. A reduction of power developed with the same boiler pressure and speed, equal to about 14 per cent.

2d. A consumption of from 3 to 5 per cent. more steam per indicated H. P. per hour.

3d. A greater proportion of back to gross pressure, amounting to 10 per cent.

It will be noticed that the increased compression causes the steam line to rise much higher than the boiler pressure in these, than in the previous cards with the greater clearance.

It would be supposed that this excess of pressure at the commencement of the stroke would have a tendency to straighten the admission line, and cause it to more nearly approach that of boiler pressure and expand with a curve more nearly coinciding with that drawn by theory. This, though it would be the case with an excess of lead, is not so in the cards of this experiment.

The greater power developed in Experiment No. 1 is due to the expansive force of a greater amount of steam confined in the cylinder when the port is closed for admission.

As the valve almost commences to close when the piston begins its stroke, the entering steam is wiredrawn (shown in all the cards), because sufficient steam to fill to boiler pressure the space swept through by the piston cannot be admitted through such a small opening.

The entering steam, in neither of these experiments, was first to fill the clearance spaces between the valve and piston, these being already filled by compressed steam nearly approaching in pressure that of the boiler. If, however, the clearance space be so great that the compressed steam fills it to a low pressure only, before the advent of lead, the result would not be economical and a reduction of this space would be beneficial.

It follows, then, that different speeds require a different amount of clearance space.

The clearance for a given size of cylinder depends on the amount of steam left in the cylinder after the port has been closed to the exhaust, and this again depends on other points of detail, such as lap, lead, size and form of steam and exhaust passages, size of exhaust nozzles, and the amount of condensation.

Since the clearance space in experimznt No. 1 is well filled by compressed steam before the advent of lead, but little fresh steam is required to bring it to boiler pressure, and we must attribute the greater H. P. developed over experiment No. 2, to the larger amount of steam in the cylinder when the valve commences to close, after which the steam entering the cylinder is about equal in each experiment.

Although a greater amount of power is developed in Experiment No. 1 from a greater amount of clearance, this power is further obtained with a decreased consumption of steam per H. P. This has been proved practically in two ways. First, by the indicator, and second by carefully measuring the amount of water used by the locomotive in working the train.

The smaller consumption of steam per H. P. in Experiment No. 1 is due to the smaller proportion of back to gross pressure.

An excess of back pressure causes the sinuous motion of the locomotive to be increased and has an injurious effect on its machinery

It will be noticed that the steam line in both experiments rises higher on the front than on the back end, but this amount is in greater proportion in Experiment No. 2. This is not caused by unequal clearance spaces, both being alike, but by the greater velocity of the piston near the front end due to the angularity of the connecting-rod and consequent greater concussion of the confined steam. This percussion of the steam gives rise to greater undulations of the admission and expansion lines; especially is this the case in throttled cards, see No. 6. To make the figures from each end more nearly alike, the lead on the front end should be reduced nearly $\frac{1}{32}$ of an inch.

The lead in Experiment No. 1 is scarcely sufficient, and an addition of $\frac{1}{32}$ in. would give a better card.

Experiment No. 3.—Since back pressure in the first notch is almost entirely composed of compression, we tried to run the engine in the third notch from centre, or 8½ in. cut-off, and with the throttle wide open. To accomplish this the length of port opened was reduced to 3½ in. by riveting strips of metal to the edges of valves, leaving a space of that length in the middle.

It was thought that the steam would be admitted at boiler-pressure to the cylinder, but would be considerably wire-drawn, and so reduce the power, and the loss from greater condensation be amply compensated by a reduction in compression.

This, however, was not the case, the steam being throttled by the slide-valve as shown in card No. 9. The consumption of steam per H. P. is 22 per cent. higher than in Experiment No. 2, caused by the lower initial pressure due to throttling.

If from the point of pre-release we draw a theoretical expansion curve, we will find that steam of 130 lbs. pressure, admitted up to 2⅝ in. of the stroke, would have developed 254.86 H. P., or about 33 per cent. more work would have been done with an equal consumption of steam.

This superior result is due to the use of a higher pressure with a corresponding amount of expansion, and to the absence of wire-drawing and condensation.

If we draw a line (front end) parallel with the atmospheric line and at the height 78 lbs., to which the steam admitted rises, we will find that steam of this pressure, not wire-drawn and cut off at 5 in. of the stroke, will indicate a power of 202.8 horses, or 14 per cent. more work than the wire-drawn steam admitted during a greater period.

This result accords closely with a rule given in a recent number of *Engineering*, July 6, 1877, which is, "That the economy of steam used expansively varies inversely, very nearly, as the square root of the pressures.

The square root of 78 = 8.84
" " " 130 = 11.4,

or a superior duty of 22 per cent. due to the use of the higher pressure. As already shown, there is a further loss of 14 per cent. due to wire-drawing; therefore the superior duty of the high pressure not wire-drawn is by this rule 36 per cent. or 3 per cent. greater than that shown by the diagram.

The compressed steam scarcely fills the clearance space in this experiment, and this defect with an insufficiency of lead delays the timely admission of steam, and a maximum pressure of 78 lbs. is only obtained after the piston has moved about 1 inch.

The theoretical figure in red lines (with the same compression as the actual figure) shows a consumption of only 15.44 lbs. of steam per indicated H. P. per hour—a result not possible to attain in actual practice. It could, however, be approached by the use of superheated steam, a good balanced valve and well-protected cylinders.

Experiment No. 4.—The unsatisfactory result of working with a port opening of only 3½ in. being proved, the opening was increased to 8½ in. by cutting the strips of metal on edges of valves.

Cards Nos. 10 and 11 show the distribution of steam with this arrangement.

Comparing them with Nos. 7 and 8, we find that the steam, though approaching boiler pressure, is considerably wire-drawn, and the power developed with an equal boiler pressure and speed 11 per cent. less.

This power is obtained with an expenditure of nearly 19 lbs. of steam per H. P., being ¾ of a pound, or 4 per cent. greater than Nos. 7 and 8.

There is in these figures (Experiment No. 4) a deficiency of lead, especially on the back end, this latter being caused by want of parallelism of the valve and port. The expansion line, from wire-drawing, falls much below the theoretical curve, and back pressure forms a large proportion of the gross pressure, being but little less than in Experiment No. 2, with its greater indicated power.

These cards are good examples of the unsatisfactory result of wire-drawn steam. That is, steam of a lower pressure admitted without wire-drawing will do the work more economically, and as an instance we may compare No. 11 with No. 25, where the latter card shows the work to be done with nearly 5 per cent. less steam per H. P.

Experiment No. 5.—The strips on edges of valves were again cut and the port opening increased to 9¼ in. The distribution is shown in Cards Nos. 12 and 13.

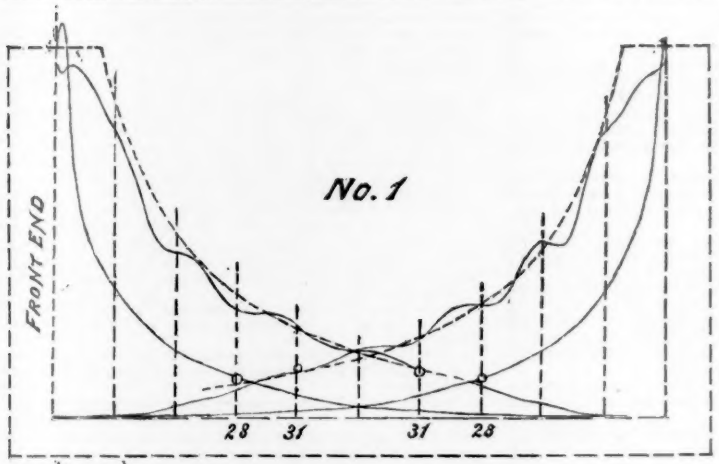
This is a slight improvement in the amount of power developed with the same steam pressure and speed. Lead is also improved.

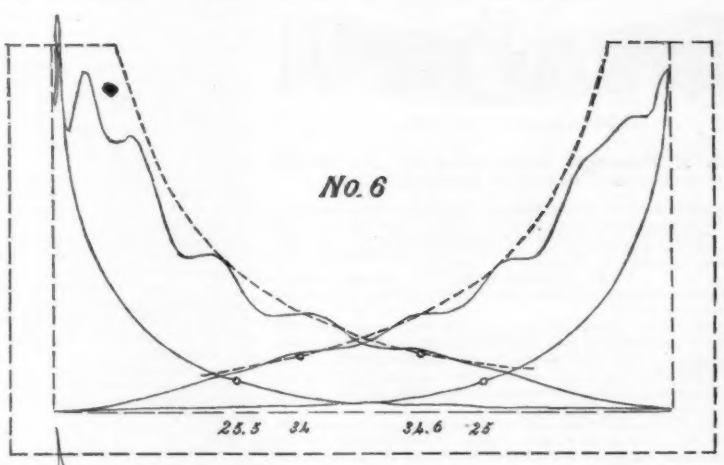
The insufficiency of this size of port for high or even ordinary speeds is very strikingly shown in card No. 13, where the steam is wire-drawn to a remarkable extent.

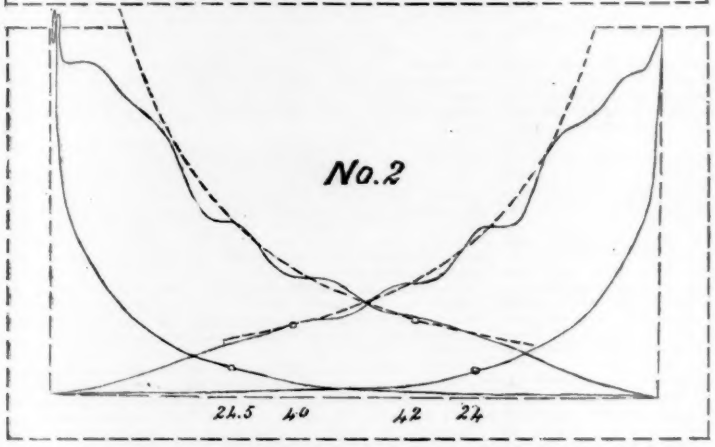
Experiment No. 6.—The port openings being further increased to 12 in., cards Nos. 14 and 15 were taken, and show a decided improvement in the behavior of the steam in the cylinder. The H. P. developed with an equal boiler pressure and speed is not so great as with a port opening of 14 in.—full length—nor is the distribution of steam so good.

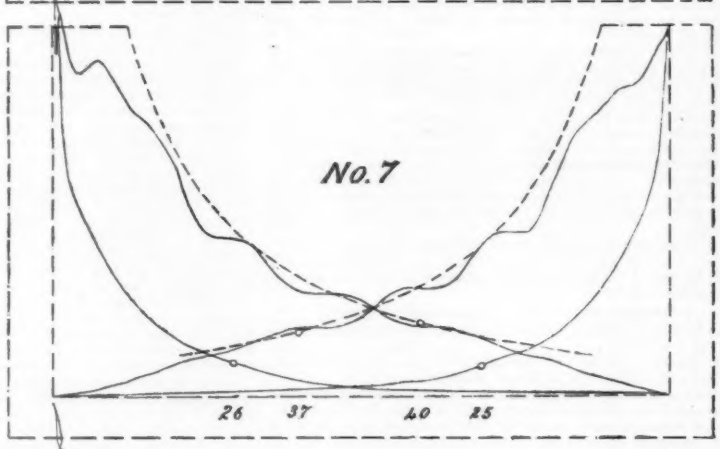
Experiment No. 7 shows the effect of opening the port 14 in., by taking the strips off the front edge of valve only, which is to increase the H. P. about 3 per cent., and to decrease the consumption of steam per indicated H. P. per hour.

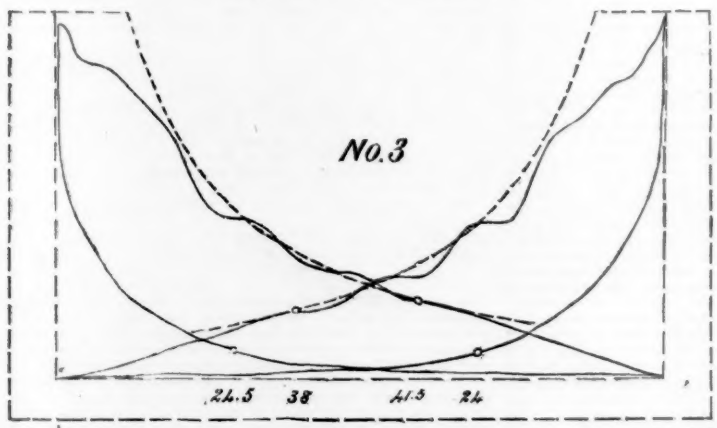
Experiment No. 8 represents the distribution of the steam with front and back ports opened full length, or 14 in. The

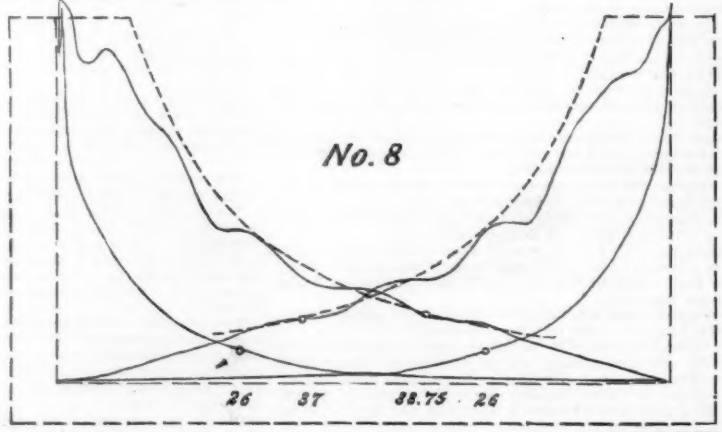


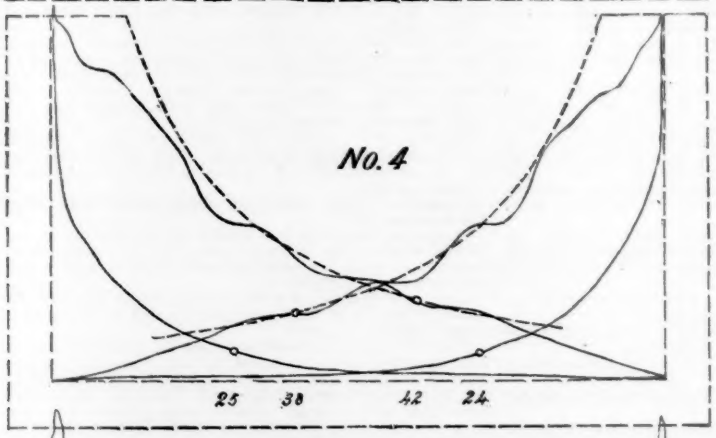


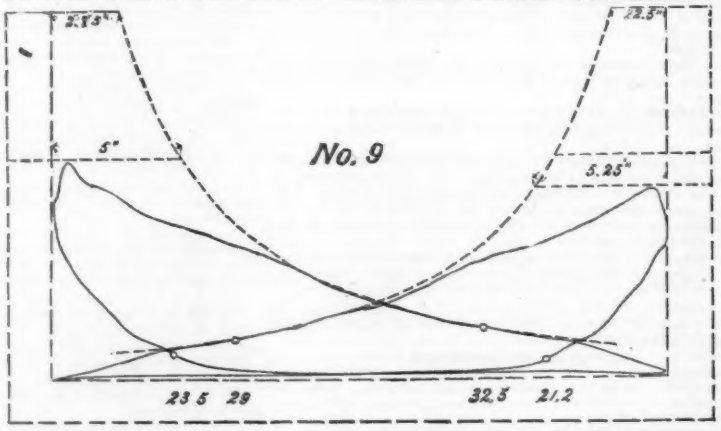


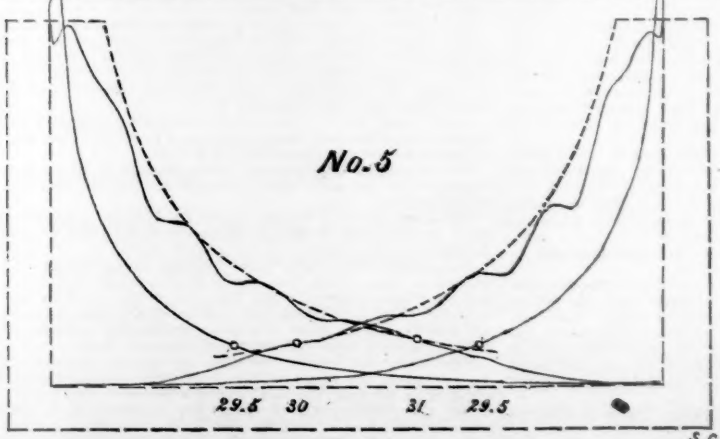


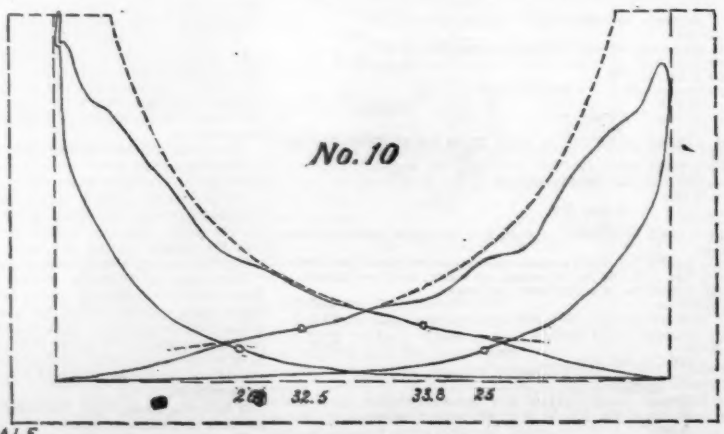


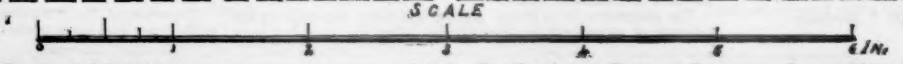












INDICATOR DIAGRAMS—*Accompanying paper of John E. Martin on Tests of Passenger Locomotives* (page 265).

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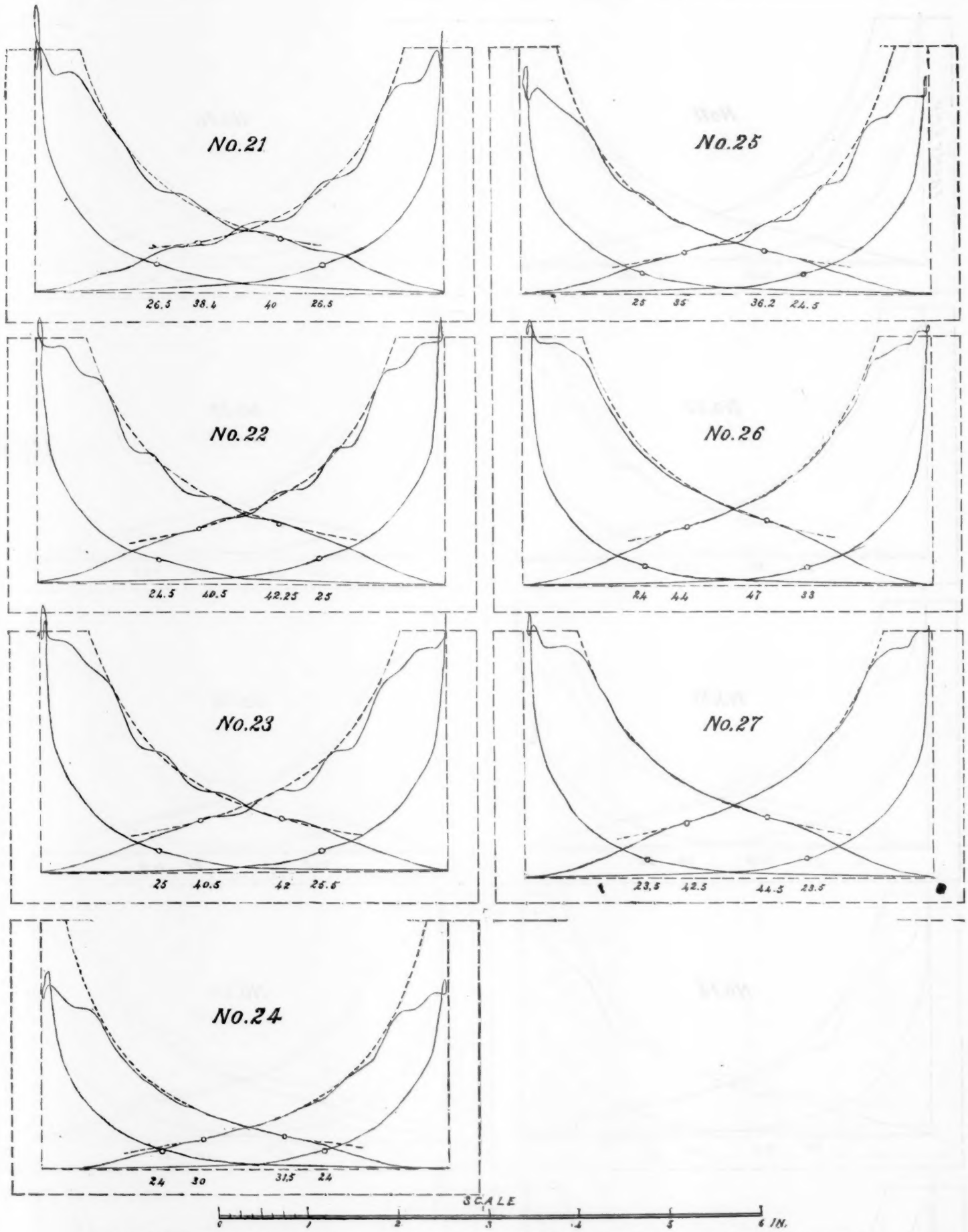

INDICATOR DIAGRAMS—*Accompanying paper of John E. Martin on Tests of Passenger Locomotives* (*page* 265).

H. P. being increased a similar amount on the back, as was previously the case with the front end.

If we now compare No. 17 with No. 8, both taken under similar conditions, we will find in No. 17 a slight increase in the H. P., developed by an equal boiler pressure and speed, and further, a reduced consumption of steam per indicated H. P. This gain is attributable to a decrease in the size of the exhaust nozzles by an accumulation of dirt. It will be noticed that the pre-release or exhaustion of the steam is not so perfect, or is more prolonged in No. 17, virtually increasing the period of expansion and the gross pressure, and this without any increase in the amount of back pressure.

The effect is more marked on the back end figure where the exhaust lead is not so great as on the front, owing to the unequal lap of valve alread mentioned.

From this it appears that an exhaust lead of $1\frac{1}{16}$ in. is too great for this locomotive in the first notch, and that better results would be obtained by decreasing it. If we did this by decreasing the lap of valve, the travel would then be still further reduced to cut off at $4\frac{1}{2}$ in., and this would cause the valve face to cut and tend to wire-draw the steam still further.

Possibly a lap of $\frac{7}{8}$ in. would give in every way as good, if not better results. The lead cannot be reduced because it would entail a loss from the steam not reaching the boiler pressure. A good example of insufficiency of lead is found in the back end of figure on card No. 19.

The only other and apparently efficient way is to decrease the size of the exhaust nozzles.

These should not be greater than $2\frac{3}{4}$ or $2\frac{5}{8}$ in. for the escape of the steam in this notch.

The beneficial effect of small nozzles is further proved in the back end figure of card No. 18, where this imperfect (if we may so call it) exhaust is more pronounced. Comparing this figure with the back end figure of card No. 7, under exactly similar conditions of speed and pressure, we find the mean pressure to be 2 lbs. greater in No. 18, giving an increase of 5 per cent. in the power developed, with a slight decrease in the consumption of steam per H. P. per hour—this last being due to the smaller proportion of back to gross pressure.

Experiment No. 9 shows the effect of taking the wrought-iron plates off the front-end cylinder-head, thereby increasing the clearance of the piston to nearly $\frac{3}{4}$ in., or a space =0.085 of cylinder contents, equal to 360 cubic inches.

The effect of this change is to lower the initial pressure, which can be remedied by an increase of lead, to increase the power developed, and to decrease the consumption of steam for indicated H. P.

The front-end figure of this card may be compared with the front-end figure of card No. 4, where the clearance is somewhat less, and it will be seen that nearly equal results are obtained with the same consumption of steam.

Experiment No. 10.—This experiment was made with the plate off both cylinder-heads, and it will be seen that while the consumption of steam per H. P. was reduced by increasing the clearance on the front end, shown in front-end figures of cards Nos. 18 and 19, it was increased on the back

EXPERIMENTS WITH DEAD GRATES—PASSENGER ENGINE NO. 9.—CHILLAN & TALCAHUANO RAILROAD.

To the Committee on Locomotive Tests, Master Mechanics' Association.

No. of Experiment.	Terminal Points on Road between which Experiments were made.	Date of Experiment.	Mileage and Speed. Distance run by train in miles.	Av. running speed, exclusive of stops in miles per hour.	Av. running speed, inclusive of stops in miles per hour.	Total time on road, in hours.	Total time for stops—hours.	Av. number of miles run to one stop.	Kind of fuel used.	Consumption of Fuel. Wood used in kindling, in lbs.	Coal used in kindling, and up to time of leaving, in lbs.	Av. weight of coal consumed per train per mile in lbs.	Av. weight of coal consumed per car mile in lbs.	Consumption of Water. Pounds of water evaporated per lb. of coal.	Pounds of water evaporated per train mile.	Pounds of water evaporated per minute while running.	Weight of train, including locomotive and tender, conveyed one mile per lb. of coal.	Steam pressure at start.	Steam pressure at terminus.	Percentage of ashes and clinker.	Extra stops for cattle on track.	Extra stops to load cattle.	Extra stops—flag stations.	Arrangement of fire-box.	Size of exhaust nozzles.	Av. evaporation per lb. of coal for each arrangement.
		1877.																								lbs.
1	Concepcion, Talcahuano & Chillan (1)	Sept. 28	125	25	20¾	6:30	1:30	10	Lebu.	66	271	22.4	5.6	7.55	153	63.7	8,930	127	127	....	..	..	..	Sketch No. 1.	3¼ in.	
2	Chillan & Talcahuano	" 29	115½	"	"	5:45	1:05	"	"	84	280	19.3	4.92	7.78	131	54.3	10,360	130	130	....	..	..	..	"	"	
3	Concepcion, Talcahuano & Chillan	" 30	125	"	"	6:30	1:30	"	"	66	321	21.2	5.3	7.03	134	55.8	9,430	127	127	14	..	..	..	"	"	
4	Chillan & Talcahuano	Oct. 1	115½	"	"	5:45	1:05	"	"	75	277	20.	5.1	7.25	127	52.5	10,000	128	125	13½	..	..	..	"	"	7.40
5	Concepcion, Talcahuano & Chillan	" 2	125	"	"	6:30	1:30	"	"	66	300	22.3	5.6	7.36	146	60.9	8,970	128	125	13	..	..	..	"	"	
6	Chillan & Talcahuano	" 3	115½	"	"	5:45	1:05	"	"	68	280	20.8	5.3	7.10	130	54.	9,610	127	125	14	..	..	..	"	"	
7	Concepcion, Talcahuano & Chillan (2)	" 4	125	"	"	6:30	1:30	"	"	66	317	20.4	5.1	7.50	134	55.8	9,800	126	120	11	4	..	..	"	2¾ in.	
8	Chillan & Talcahuano	" 5	115½	"	"	5:45	1:05	"	"	75	286	19.2	4.9	7.48	124	51.4	10,420	126	120	15	4	2	6	"	"	
9	Concepcion, Talcahuano & Chillan	" 11	125	"	"	6:30	1:30	"	"	66	317	24.8	6.2	7.24	160	66.9	8,070	128	125	12	..	..	..	"	"	7.36
10	Chillan & Talcahuano	" 12	115½	"	"	5:45	1:05	"	"	75	308	20.6	5.3	7.48	134	55.6	9,700	126	126	14	..	2	3	"	"	
11	Concepcion, Talcahuano & Chillan	" 13	125	"	"	6:30	1:30	"	"	66	315	23.7	5.9	7.44	157	65.6	8,440	122	110	13	2	3	4	"	"	
12	Chillan & Talcahuano	" 14	115½	"	"	5:45	1:05	"	"	66	295	19.	4.9	7.36	122	50.4	10,520	125	110	13	3	3	3	"	3 in.	
13	Concepcion, Talcahuano & Chillan	" 15	125	"	"	6:30	1:30	"	"	66	312	21.8	5.4	7.24	140	58.4	9,170	126	110	13	..	..	..	"	"	
14	Chillan & Talcahuano	" 16	115½	"	"	5:45	1:05	"	"	73	293	24.4	6.2	7.18	158	65.3	8,200	130	110	13	..	..	..	"	"	
15	Concepcion, Tacahuano & Chillani	" 17	125	"	"	6:30	1:30	"	"	66	306	29.5	5.1	7.52	135	56.5	9,750	128	110	12	..	..	..	"	"	7.34
16	Chillan & Talcahuano	" 18	115½	"	"	5:45	1:05	"	"	73	275	20.3	5.2	7.89	141	58.4	9,850	129	120	12	2	3	2	"	"	
17	Concepcion, Talcahuano & Chillan	" 19	125	"	"	6:30	1:30	"	"	66	284	20.	5.	7.70	136	56.9	10,000	130	110	12½	..	3	3	"	"	
18	Chillan & Talcahuano	" 20	115½	"	"	5:45	1:05	"	"	70	286	20.6	5.3	7.76	141	58.	9,700	127	112	12	..	3	3	"	"	7.72
19	Concepcion, Talcahuano & Chillan	" 26	125	"	"	6:30	1:30	"	"	66	323	22.9	5.7	7.51	153	63.7	8,730	119	118	12½	2	3	2	"	"	
20	Chillan & Talcahuano	" 27	115½	"	"	5:45	1:05	"	"	66	273	18.2	4.6	7.76	123	50.	11,000	130	112	13	4	3	1	"	"	
21	Concepcion, Talcahuano & Chillan	" 28	125	"	"	6:30	1:30	"	"	66	319	21.2	5.3	7.51	140	58.3	9,430	122	112	11	4	2	4	"	"	
22	Chillan & Talcahuano	" 29	115½	"	"	5:45	1:05	"	"	66	279	22.6	5.8	7.41	150	61.8	8,850	125	110	11½	4	2	4	"	"	
23	Concepcion, Talcahuano & Chillan	" 30	125	"	"	6:30	1:30	"	"	66	286	20.3	5.1	7.40	132	55.5	9,850	128	110	13	4	4	4	"	"	
24	Chillan & Talcahuano	" 31	115½	"	"	5:45	1:05	"	"	66	280	19.6	5.	7.22	125	51.4	10,200	125	115	12½	4	..	4	"	"	7.47
25	Concepcion, Talcahuano & Chillan	Nov. 1	125	"	"	6:30	1:30	"	"	66	275	20.6	5.1	7.35	136	56.5	9,700	110	110	12	4	1	2	"	"	
26	Chillan & Talcahuano	" 2	115½	"	"	5:45	1:05	"	"	66	280	20.7	5.3	7.35	134	55.4	9,660	130	115	12	4	..	1	"	"	
27	Concepcion, Talcahuano & Chillan	" 3	125	"	"	6:30	1:30	"	"	66	284	21.2	5.3	7.30	138	57.7	9,430	125	110	12	4	1	3	"	"	
28	Chillan & Talcahuano	" 4	115½	"	"	5:45	1:05	"	"	66	304	32.1	5.6	7.41	145	60.	9,050	125	110	12	4	1	2	"	"	7.35
29	Concepcion, Talcahuano & Chillan	" 10	125	"	"	6:30	1:30	"	"	66	282	19.1	4.8	7.69	130	54.1	10,470	128	90	11½	3	1	2	"	"	
30	Chillan & Talcahuano	" 11	115½	"	"	5:45	1:05	"	"	66	300	20.3	5.2	7.30	132	54.5	9,850	125	115	11½	3	1	2	"	"	
31	Concepcion, Talcahuano & Chillan	" 12	125	"	"	6:30	1:30	"	"	66	288	20.6	5.1	7.81	143	59.6	9,700	112	90	10	1	1	2	"	"	
32	Chillan & Talcahuano	" 13	115½	"	"	5:45	1:05	"	"	66	300	20.7	5.3	7.70	140	57.6	9,660	124	118	11	1	3	2	"	"	
33	Concepcion, Talcahuano & Chillan (3)	" 14	125	"	"	6:30	1:30	"	"	66	282	20.5	5.1	7.50	137	57.2	9,750	129	115	12	1	1	2	"	"	
34	Chillan & Talcahuano	" 15	115½	"	"	5:45	1:05	"	"	66	275	21.6	5.5	7.60	145	60.	9,210	125	112	11½	2	2	2	"	"	
35	Concepcion, Talcahuano & Chillan	" 16	125	"	"	6:30	1:30	"	"	66	251	20.3	5.1	7.50	137	57.2	9,850	128	113	12	1	3	1	"	"	7.60
36	Chillan & Talcahuano	" 17	115½	"	"	5:45	1:05	"	"	66	251	18.4	4.7	7.53	123	50.	10,870	125	112	12	2	1	3	"	"	
37	Concepcion, Talcahuano & Chillan	" 18	125	"	"	6:30	1:30	"	"	66	264	20.1	5.1	7.59	137	56.9	10,000	98	85	13	2	1	3	"	"	
38	Chillan & Talcahuano	" 19	115½	"	"	5:45	1:05	"	"	66	264	19.4	5.	7.63	130	54.	10,300	127	110	13	3	3	3	"	"	
39	Concepcion, Talcahuano & Chillan (4)	" 25	125	"	"	6:30	1:30	"	"	66	271	21.8	5.4	7.45	146	60.7	9,170	109	95	12	2	..	..	"	"	7.56
40	Chillan & Talcahuano	" 26	115½	"	"	5:45	1:05	"	"	66	268	21.5	5.5	7.38	141	58.5	9,300	123	110	12	2	..	1	"	"	
41	Concepcion, Talcahuano & Chillan (5)	" 27	125	"	"	6:30	1:30	"	"	66	268	19.5	4.9	7.64	129	53.7	10,250	110	109	12½	1	..	..	"	3½ in.	
42	Chillan & Talcahuano (6)	" 28	115½	"	"	5:45	1:05	"	"	66	264	20.7	5.3	7.46	137	56.7	9,660	130	119	12	2	1	2	"	"	
43	Concepcion, Talcahuano & Chillan (7)	" 29	125	"	"	6:30	1:30	"	"	66	300	20.1	5.	7.30	130	54.	10,000	122	100	12½	..	..	..	"	"	7.48
44	Chillan & Talcahuano.. (8)	" 30	115½	"	"	5:45	1:05	"	"	66	257	20.3	5.2	7.30	131	54.3	9,850	127	115	12	1	1	..	"	"	
45	Concepcion, Talcahuano & Chillan (9)	Dec. 1	125	"	"	6:30	1:30	"	"	66	284	20.	5.	7.54	133	55.7	10,000	130	109	12	3	..	3	"	"	
46	Chillan & Talcahuano (10)	" 2	115½	"	"	5:45	1:05	"	"	66	280	19.6	5.	7.65	131	54.3	10,200	128	113	13	..	..	..	"	"	
47	Concepcion, Talcahuano & Chillan (11)	" 3	125	"	"	6:30	1:30	"	"	66	297	19.7	4.9	7.86	136	57.	10,150	126	115	12½	2	..	..	"	2¾ in.	
48	Chillan & Talcahuano	" 4	115½	"	"	5:45	1:05	"	"	66	277	19.2	4.9	7.56	126	52.1	10,420	127	111	13	1	..	..	"	"	7.53
49	Concepcion, Talcahuano & Chillan	" 10	125	"	"	6:30	1:30	"	"	66	271	20.8	5.2	7.90	147	61.3	9,000	120	95	12½	2	1	2	"	"	
50	Chillan & Talcahuano	" 11	115½	"	"	5:45	1:05	"	"	66	271	19.3	4.9	7.70	131	54.	10,360	122	108	12½	1	3	..	"	"	
51	Concepcion, Talcahuno & Chilian	" 12	125	"	"	6:30	1:30	"	"	66	275	19.3	4.8	7.72	132	55.1	10,360	127	104	13	3	..	..	"	"	
52	Chillan & Talcahuano	" 13	115½	"	"	5:45	1:05	"	"	66	275	20.3	5.2	7.76	139	57.4	9,850	127	109	12½	2	2	..	"	"	
53	Concepcion, Talcahuano & Chillan	" 14	125	"	"	6:30	1:30	"	"	66	275	18.8	4.7	7.75	129	53.7	10,640	123	107	13½	2	2	..	"	"	
54	Chillan & Talcahuano	" 15	115½	"	"	5:45	1:05	"	"	66	270	18.4	4.7	7.72	124	51.3	10,870	125	110	13½	2	..	..	"	"	
55	Concepcion, Talcahuano & Chillan (12)	" 16	125	"	"	6:30	1:30	"	"	66	284	18.9	4.7	7.68	128	53.3	10,580	118	95	13½	1	3	2	"	"	7.77
56	Chillan & Talcahuano (13)	" 17	115½	"	"	5:45	1:05	"	"	66	270	18.3	4.7	7.58	113	46.6	10,930	127	111	14	3	..	..	"	"	
57	Concepcion, Talcahuano & Chillan (14)	" 18	125	"	"	6:30	1:30	"	"	66	275	20.8	5.2	7.44	139	57.8	9,600	128	108	13	..	1	1	"	"	
58	Chillan & Talcahuano (15)	" 19	115½	"	"	5:45	1:05	"	"	66	275	21.6	5.5	7.28	140	57.8	9,210	130	112	12½	3	..	5	"	"	
59	Concepcion, Talcahuano & Chillan	" 25	125	"	"	6:30	1:30	"	"	66	200	20.	5.	8.	140	58.4	10,000	97	100	12½	2	1	2	"	"	7.50
60	Chillan & Talcahuano	" 26	115½	"	"	5:45	1:05	"	"	66	268	18.4	4.7	7.67	124	51.	10,870	127	111	13	2	..	2	"	"	
61	Concepcion, Talcahuano & Chillan	" 27	125	"	"	6:30	1:30	"	"	66	266	18.8	4.7	7.83	130	54.3	10,640	130	110	13½	1	..	..	"	3½ in.	
62	Chillan & Talcahuano	" 28	115½	"	"	5:45	1:05	"	"	66	266	18.3	4.7	7.74	124	51.	10,930	124	112	14	..	..	1	"	"	
63	Concepcion, Talcahuano & Chillan	" 29	125	"	"	6:30	1:30	"	"	66	264	19.5	4.9	7.76	135	56.	10,250	127	106	12½	..	..	1	"	"	
64	Chillan & Talcahuano	" 30	115½	"	"	5:45	1:05	"	"	66	249	16.6	4.2	7.65	112	46.3	12,000	130	103	14	1	1	..	"	"	
65	Concepcion, Talcahuano & Chillan (16)	" 31	125	"	"	6:30	1:30	"	"	66	284	20.	5.	7.45	132	55.1	10,000	130	109	12	2	..	..	"	"	
		1878.																								
66	Chillan & Talcahuano (17)	Jan. 1	115½	"	"	5:45	1:05	"	"	66	280	19.6	5.	7.63	131	54.3	10,200	128	113	12½	3	..	..	"	"	
67	Concepcion, Talcahuano & Chillan (18)	" 2	125	"	"	6:30	1:30	"	Puchoco, mid. seam.	66	250	18.4	4.6	8.23	135	56.	10,870	129	102	8	3	..	3	"	"	7.72
68	Chillan & Talcahuano (19)	" 10	115½	"	"	5:45	1:05	"	" "	66	244	18.6	4.7	8.42	138	57.	10,750	130	110	8	2	..	6	"	3¼ in.	
69	Concepcion, Talcahuano & Chillan (20)	" 26	125	"	"	6:30	1:30	"	Veta Chica, Puchoco.	66	257	17.	4.2	8.77	130	54.3	11,800	122	95	5½	3	..	1	"	"	
70	Chillan & Talcahuano	" 27	115½	"	"	5:45	1:05	"	" "	66	242	16.	4.	8.88	124	51.3	12,500	130	109	6	2	..	6	"	2¾ in.	

(1) Fire-door 3 in. open in this and all other experiments, unless otherwise stated.
(2) Nozzles reduced by dirt to 2¾ in. The coal used in these four experiments was slightly different, and they are not, therefore, comparable.
(3) Piston blowing through.
(4) In this and following experiment no diaphragm plate was used in smoke-box.
(5) Door 4 in. open.
(6) Fifteen minutes' extra delay.
(7) Door 4 in. open.
(8) Door 4 in. open.
(9) Door 4 in. open.
(10) Door 4 in. open.
(11) Nozzles reduced by dirt.
(12) No baffle plate.
(13) No baffle plate.
(14) No baffle plate.
(15) No baffle plate.
(16) Door 4 in. open.
(17) Door 4 in. open.
(18) Fire door 5 in. open.
(19) Fire door 5 in. open.
(20) Nozzles reduced by dirt.

This is a different coal, and the arrangement shown in Fig. 8 gave the best results. "Veta Chica" is the upper seam, and is the best for locomotive purposes.

Number of driving wheels, 4.
Diameter of driving wheels, 5 ft. 5 in.
Length of driving wheel base, 7 ft. 8 in.
Length of total wheel base, 21 ft. 3 in.
Total weight of engine in working order, in lbs., 60,000.
Total weight on driving wheels, in lbs., 39,000.
Size of cylinder, in inches, 15×24.
Size of steam ports, in inches, 14×1¼.
Size of exhaust, in inches, 14×2½.
Greatest travel of valve, in inches, 5¼.
Lead in full gear, 3-64.
Lead in 1st notch from centre, 3-16.
Outside lap of value, 15-16.
Inside lap of valve, —.
Inside clearance, 1-32.
Size of grate, 57×43.
Width of opening of grate bars, ⅜ in.
Height of fire-box from top of grate, 58 in.
Outside diameter of smallest ring in waist of boiler, 46 in.
Number of tubes, 138.
Outside diameter of tubes, 2 in.
Length of tubes, 11 ft.
Material of tubes, copper.
Ferrule area in square inches, 262.
Square feet of grate surface, 15¾.
Square feet of heating surface in tubes, 695.
Square feet of heating surface in fire-box, 91.
Square feet of heating surface in total, 786.
Height of exhaust nozzles in inches, 11.
Kind of stack, open.
Diameter of inside pipe in inches, 13 to 15.
Wagon top boiler with one dome.
Average number of cars on trip, "Concep., Talcah. & Chillan," 4.
Average number of cars on trip, Chillan to Talcahuano, 3.92.
Total weight of train, including locomotive and tender, 200,000 lbs.
Actual weight of cars, 106,000 lbs.
Baffle plate used in all experiments, except Nos. 55, 56, 57 and 58.
Brick arch used in all experiments.
Pump and no injector used in all experiments.
Petticoat pipe used in all experiments.
Double exhaust nozzles used in all experiments.
The evaporation of water is the amt. evaporated per lb. of coal, exclusive of the amount used for kindling and up to starting time. This coal is, however, included in the amount of "Coal used per train, and car mile," and in making out the weight of train moved one mile per lb. of coal.
Maximum grade on road is 52 feet to a mile.
Vertical distance between highest and lowest points on road, in feet, 394.
Shortest radius of curve, in feet, 1,000.
Number of curves, 200.
By ashes and clinker is meant, everything left in the fire-box and ash-pan at completion of trip and generally includes some small particles of coke that remain on the dead plates.
The difference in consumption of water on similar trips is entirely caused by the wind, which blows with a force varying from 1 to 20 miles per hour.
Temperature of gases in the smoke-box from 450° to 500°.
Vacuum in smoke-box (in water) from ⅝ in. to 1⅛ in.
H. P. required to move the train, from 120 to 220, according to grade and force of wind.
Temperature of feed water, 58°.
Temperature of atmosphere, 60°.
Average steam pressure, 127 lbs.

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end. This is the result of insufficient lead and by cleaning out the exhaust nozzles.

A marked result due to the greater clearance spaces is the closer approach of the line of expansion to the theoretical curve.

This is well defined in all the cards, but more particularly proved in cards Nos. 17, 18 and 19.

The effect on this line of the greater clearance in the front over the back-end figure in card No. 18 is very striking, as is also its effect on the back-end figure in No. 19, where there is an insufficiency of lead.

Here, again, the proportion of back to gross pressure is much reduced, and the distribution of steam is similar to that of cards in Experiment No. 1, which have been already proved superior to those taken with the smaller clearance space.

Experiment No. 11.—Since there is an apparent want of lead in No. 19, the valves were reset and the lead increased from $\frac{1}{32}$ in. to $\frac{1}{16}$ in., and cards Nos. 20 and 21 were taken.

There is too much lead on the front end of these cards, and the eccentric rod was shortened $\frac{1}{16}$ in., increasing the lead on the back and decreasing it on the front by that amount.

Experiment No. 12.—With above alteration, cards Nos. 22 and 23 were taken.

Although the lead in these figures is a trifle too great, the results as regards a good, economical distribution are unequaled by any of the other experiments.

The steam line rises slightly in excess of boiler pressure, the admission line is well maintained, and the line of expansion closely follows the theoretical curve, and the proportion of back to gross pressure is very low.

The effect of clean nozzles on the line of pre-release is clearly shown in these cards.

The consumption of 17⅕ lbs. of water per H. P. per hour is not equaled in any other experiment, especially when we take into account the lower boiler pressure and greater indicated power.

As examples of a high expansive duty of steam in the locomotive, these cards are well worthy of study.

They might be improved by decreasing the size of the exhaust nozzles, slightly decreasing the lead and possibly the lap. A further improvement would be the use of superheated steam.

Card No. 21 shows the rapid use of compression at high speeds and would indicate that the lead should be decreased and that an increase of clearance would be beneficial with an increase of speed, and further, that exhaust nozzles of 3¼ in. diameter are too large for even high speeds

Although it has been proved that a clearance space equal to 0.085 of cylinder contents gives the best result where the full boiler pressure of 130 lbs. is used, this is not the case

when the steam is very much throttled, because there is then less compression, and as a consequence the clearance space is only filled with steam of low pressure.

The foregoing conclusions are not alone based on the evidence of the indicator, but have been more practically proved by careful measurement of the water used by the locomotive, and I subjoin four cards illustrative of the power required to the train under the most favorable condition of rail, wind and atmospheric temperature: one extra passenger car makes a difference of exactly 5 per cent. in fine weather.

The engine, except when starting, is always run in the first notch, and the variations of speed on different parts of the road, always the same; in fact, much is due to the care and interest of the engineman during the trials.

Card No. 24 represents the least amount of power developed by the locomotive, and was taken on a level piece of track, but with a number of curves of 1,000 feet radius.

Card No. 25 was taken a little later, on a straight and nearly level piece of track, just before taking a short 1 per cent. grade. This card is a good example of the average work done by the locomotive on the round trip.

Cards Nos. 26 and 27, taken on the grade, show that the engine is capable of hauling the train up a 1 per cent. grade at a speed of 20 miles per hour.

The power required to move the train is greatly increased by the force of the wind, and with a head wind traveling at the rate of 20 miles an hour, at least 30 per cent. more power is required.

A table containing the result of some experiments on the extra power required with different velocities of wind is appended.

Sometimes, though seldom, the resistance from this cause is so great as to demand more power than can be furnished in the first notch, although its range of power is admirably suited to all circumstances affecting the running of this train.

It has been found in practice that the distribution of steam shown in cards Nos. 22 and 23 is the best when the throttle has to be opened wide. On a fine day, when less power is required, the distribution shown in Experiment No. 1 is somewhat superior. This I attribute solely to the smaller amount of lead in Experiment No. 1, and consequent prolonged expansion.

In Experiment No. 2 the lead is too great, and the prerelease of the steam too much hastened; particularly is this the case with low speed.

A difference in the temperature of the atmosphere has an effect on the tractive force required to haul the train. This is due to the inferior lubrication of the bearings of engine and cars on the colder day, and there may possibly be more condensation.

The amount of steam used as per indicated H. P. per hour, as shown on the cards, is not the actual consumption of the locomotive, but somewhat less. I believe as much as 10 per cent. is lost by condensation and other causes.

Whatever may be this quantity, it is the same in all the experiments and does not alter their comparative value.

The cylinders in these experiments were lagged with hair, felt and wood and cased with Russia sheet-iron. The cylinder-heads were not lagged, but covered by a cast-iron casing in the usual way.

Since the above experiments were made, the cylinders were relagged with felting, asbestos board and wood and covered with sheet-iron. The cylinder-heads were treated in the same way. Indicator cards did not show any improvement, although there must have been a beneficial result.

A small hole was bored through the cylinder-head and flange of cylinder, and a delicate thermometer introduced between the wood lagging and sheet-iron casings.

The thermometer, when the engine stopped at a station, indicated 110° Fah. When the bulb was allowed to rest on the cylinder-head the temperature rose to 260°. There was a slight leakage of the throttle during the observations.

Recapitulation.—The following conclusions have reference only to the use of steam in the first notch and with a maximum steam pressure of 130 lbs.

1. Steam may be successfully used in the first notch with economy of fuel and without materially increasing the cost of repairs to the machinery of the locomotive, provided the water is good and care be used to keep the valves well lubricated.

2. To get the maximum results the valve gear must be in good order and the valves very carefully set.

3. A lap greater than $\frac{1}{16}$ in. with a travel of 5¼ in. is not required, and there is reason to believe that a lap of ⅛ in. would give equally good results.

4. Inside clearance is considered better than inside lap, as it delays the closing of the exhaust and thereby decreases compression.

5. *Lead* has a greater influence on the distribution of the steam in this notch, Too little, when working within the maximum power developed, is better than too much. The proper amount of lead for speeds from 25 to 35 miles per hour with a clearance space equal to 0.076 to 0.085 of cylinder contents is $\frac{3}{16}$ in. When the clearance is less, a smaller amount of lead is sufficient. At higher speeds less lead is required, because compression is much greater and of itself raises the steam line to a greater height before the advent of lead.

A proper amount of lead maintains the admission line nearer to that of boiler pressure and prevents condensation, or fall of pressure, after the port is closed.

Too much lead increases the gross pressure, but it also increases the back pressure from excessive compression, and although the H. P. may be increased, the steam used per H. P. per hour will also be greater.

Again, too much lead, by increasing the compression, is detrimental to the machinery and gives the engine an unsteady motion.

6. *Nozzles.*—The exhaust nozzles of a locomotive may be too large for the escape of the steam, an assertion which although at variance with the general opinion of master mechanics, is yet proved by these indicator diagrams. Not only has this been proved in one but in four locomotives on the same train, where the nozzles have been varied in diameter from 2⅝ in. to sizes up to 3⅝ in., and there was no gain in the change.

Exhaust nozzles from 2¾ in. to 3 in. are quite large enough for the perfect escape of the steam from the cylinder while working with a full-opened throttle in this notch and at speeds up to and even greater than 40 miles an hour.

With nozzles above this size there is a loss in power, with the same consumption of steam, owing to the too rapid exhaustion of the steam during purchase.

7. *Size of Port.*—A long port equal in length to the diameter, or nearly so, of the cylinder is superior to a shorter one for the admission of steam, owing to the small amount of port opened by the valve in this notch.

This is clearly proved in the experiments made with different lengths of port opening, where in every case the power developed by the longer port is proved to be the greater, and further, to be obtained with a decreased consumption of steam per horse-power.

This result is due to the greater wire-drawing of the steam during admission with the smaller port opening.

If the port itself had been reduced in size, instead of reducing the opening, by putting the strips on the valves the results would have been still worse, because exhaustion would have been imperfect and the amount of clearance space insufficient.

8. *High Pressure.*—The benefit to be obtained by high pressure steam in this notch is due to the greater power developed in proportion to the steam used, the back pressure being constant, or nearly so, independent of the initial pressure. This is proved by comparing No. 23 with No. 24, in both of which the back pressure is about equal, although the H. P. in the former is double that of the latter.

Although a higher pressure than 130 lbs. would give a greater power, the work would be done with very little less than 17½ lbs. of water per H. P. per hour.

But should more power be required than can be furnished in this notch with 130 lbs. of steam, the use of a higher pressure would be the better way of supplying it, instead of running the engine in the second notch with a partially opened throttle.

[TO BE CONTINUED.]

MASTER MECHANICS' ASSOCIATION.

Proceedings of the Eleventh Annual Convention.

THIRD DAY.

At the opening of the session on the third day the report of the Committee on Locomotive Tests, consisting of Wm. Woodcock, of the Central Railroad of New Jersey; S. A. Hodgman, of the Philadelphia, Wilmington & Baltimore, and David Clark, of the Lehigh Valley Railroad, was read.. This report was published in the *Railroad Gazette* of last week. The report was discussed at considerable length, and the relative merits of the American, Mogul and Consolidation types of locomotives was considered.

An invitation was received from the Committee on Entertainment—John McFarland, Esq., chairman—tendering the members of the Association and their ladies, at 3½ o'clock, p. m., a drive through the city and to places of historic interest in the vicinity. The invitation was accepted, not as an Association but individually.

Mr. F. B. Miles, of Philadelphia, read a paper, which was also published in full in last week's *Railroad Gazette*, on the Relations of Capital and Labor in Railroad Service. A vote of thanks was tendered to Mr. Miles after the reading of his paper.

A paper from Mr. Gordon H. Nott, on Combustion, was presented and referred to the Supervising Committee, with instructions to have printed in the annual report such portions as they deem proper.

The following gentlemen were appointed a committee on resolutions: Mr. John Swift of Schenectady, Mr. Barnett of the Grand Trunk Railway and Mr. F. B. Miles of Philadelphia.

The following question, submitted by Mr. Woodcock, of the New Jersey Central, was read: "What is the best plan of testing boilers, hydraulic pressure or otherwise?"

Different methods of testing steam boilers were then very fully discussed by Messrs. Woodcock, Johann, Sedgley, Wells, Rushton, Hudson and Hayes. Different methods were described, some of the members being in favor of the hydrostatic test with cold water, others preferred a test made by filling the boiler full of cold water and then heating it with a light fire, so that the expansion of the water would produce the requisite pressure. Other members thought that the best test was that which subjected the boiler to a pressure under as nearly as possible the same conditions as would exist when it was at work, and therefore they filled the boiler with water to the height required when the engine is at work and then generated strain of the pressure required for the test.

The question, "What is the best material for tender frames?" was then discussed by Messrs. Boon, Lander, Sedgley, Hudson and Cooper. The majority of those who took part in the discussion were in favor of iron tender frames, although Mr. Hudson favored wooden frames for their cheapness.

The next business in order being the election of officers, on motion of Mr. W. Woodcock the election was postponed until the next annual convention, which continues the old officers another year, in accordance with the uniform practice of the Association.

Mr. Hudson, from the Committee on Subjects for Consideration the Coming Year, reported as follows:

1. Lubricants.
2. Best material, methods, forms, proportions of constructing locomotives, and the best method of promoting economy in the use of fuel.
3. Long runs.
4. Comparative performance of locomotives with regard to fuel and work done.
5. Best form and material for locomotive wheels and axles.

The report was received and adopted.

Mr. Jacob Johann, Chairman of the committee appointed to draft resolutions in regard to the death of A. J. Hanglin, Master Mechanic of the Texas Pacific Railway, reported a resolution expressing the regrets of the Association at the death of their late associate, which was unanimously adopted.

The committee on the selection of the next place of meeting of the Association named Niagara Falls, Cleveland and Cincinnati. Cincinnati was selected by a large majority.

By a unanimous vote the Association, on motion of Mr. Johann, fixed the pay of Mr. J. H. Setchel, Secretary, at $700.

Mr. Setchel responded briefly but appropriately to the merited compliment paid him by his fellow-members.

After resolutions of thanks to the citizens of Richmond, the press and the railroad companies for courtesies, the convention adjourned to meet in Cincinnati on the second Tuesday in May, 1879.

Contributions.

The Running Gear of Cars.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of April 5, under the title, "The Running Gear of Cars," I find "A. M. W." credited with the following:

"At each instant of time the wheel must be slidden laterally upon the rail, a certain minute distance. However minute this distance, it must be produced by a force adequate to slide the wheel on the surface of the rail, *and this force is and can be supplied only by the reaction of the rail against the flange.*"

[The italics are mine.]

If a horse travels in a circle upon ice, drawing after him a wagon, the centre of gravity of the wagon, according to the above theory of "A. M. W.," would move in a straight line, since there is no "*reaction of the rail against the flange*," nor anything corresponding to it."

Most people who are not very thoroughly up in the difference between "statical pressure and dynamic energy" would suppose that the wagon would move nearly on the arc of the same circle on which the horse walked, or else that there would be a severe strain on the traces, sufficient to "*wag*" the horse like Dundreary's dog, when the tail "wath stwonger than the dog."

Is it not the fact that the force which deflects the locomotive truck is that which "A. M. W." supposes—"the reaction of the rail against the flange"—and that this force acting on the truck and through the leverage of the truck on the drivers is the principal force that deflects the remainder of the locomotive, while traction of the latter toward the centre of the curve is the *main* cause of the deflection of the tender and train?

In some cases the "reaction of the rail against the flange" and the elevation of the outer rail, *assist* to deflect the tender and train, and also the rear of the locomotive.

When a train is backed around a curve, the traction toward the centre being absent, these causes are those that make it follow the curve; but in this case, as we all know, the cars are much more liable to mount over the outer rail than if the locomotive is ahead and drawing.

Does not the comparatively slight difference in the wear on the outer and inner rails of a curve tend to prove that the deflection of the train must be largely due to some other cause than the "reaction of the rail against the wheel," and, further, is not the abrasion of the rails which actually occurs, and which "you wisely pass over in silence," accounted for by the action of the wheels as above noted, and by the action of the rear wheel of each truck on the inner rail?

With regard to the experiments made with models (see issue of May 17), the books teach that when a body is set in motion under the action of a given force, it will continue to move in the same direction and with the same velocity until acted upon by some other force.

Reasoning from this leads to the conclusion that if a body is acted upon by two forces not in the same direction, the path described will be somewhat different from that taken under the action of the single force, and if more forces be introduced the path will be still more modified.

In the case of the first model the single initial force is the traction, while two of the modifying forces are the action of gravity down the plane and the resistance of the plane to sliding friction.

The reason why "A. M. W.'s" first model traversed a straight line (apparently) instead of a curve, is that the rolling friction was so slight in comparison with the other forces that its resistance was overcome before they had time to act perceptibly.

If his model had been sufficiently long his truck would probably have described a curve.

As to his second model—two conic frustrums fixed in a rectangular frame—if the cones have equal and homologous parts their action as to direction exactly counteracts each other, and while the forward one tends to turn the frame in one direction, the rear one, with an equal force, tends to turn it in the opposite, and the result is a strong transverse strain on the frame, but a rectilinear motion. C.

MAY 27, 1878.

Copyrights on Blanks for Car-Reporting—The "Junction Exchange Report."

CHICAGO, May 25, 1878.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of May 24 there is a communication from Mr. Davies, in which he states that his records belong to him by copyright.

The records of my system belong to me by copyright, and over fifty railroads and fast-freight lines are now using them.

The "Junction Exchange Report" is not copyrighted, and will not cost any one a cent for the right to use it.

F. M. LUCE, Car Accountant,
Chicago & Northwestern Railway.

The Problem of the Trains.

COVINGTON, Virginia, May 26, 1878.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I give below a solution of the problem published in your last number:*

Let n = The speed of the mail train per hour. m = The speed of freight per hour.

Let x = The length of the railroad, a = distance from terminus to the place of collision.

Now $\frac{x}{n}$ = The number of hours in which the mail train will perform the journey.

And $\frac{x}{m}$ = The number of hours in which the freight train will perform the journey.

Hence $\frac{x}{m} - \frac{x}{n} = \left(\frac{n-m}{m\,n}\right) x$ = The number of hours the freight started in advance of the mail. Equation (6).

And $\left(\frac{n-m}{m\,n}\right) x \times m = \left(\frac{n-m}{n}\right)$ x = The number of miles the freight is ahead at the time the mail starts.

$\frac{2}{3}x - \left(\frac{n-m}{n}\right) x = \left(\frac{3\,m-n}{3\,n}\right) x$ = The distance the freight traveled, from the time the mail started, until the speed of the freight

* We repeat the problem that the reader may not be troubled to refer to it:

"A mail train upon a railway starts a certain time after a freight train from the same terminus; and the time is so adjusted that, before arriving at the other terminus, the trains will exactly escape collision and no more. It happens, however, that from an accident, the speed of the freight train is suddenly reduced one-half, after performing two-thirds of the journey, and a collision takes place a miles from the end of it. The proper speeds of the trains being m and n ($m < n$), find the length of the railway, and the difference of the times of starting (m and n), denote miles per hour."—EDITOR.

was diminished one-half or two-thirds of the journey was performed by the freight since it started.

If we multiply this last equation by n, and divide by m, we shall have the distance traveled by the mail, when the freight has performed two-thirds of the journey. Hence

$$\left(\frac{3m-n}{3n}\right)x \times \frac{n}{m} = \left(\frac{3m-n}{3m}\right)x,$$ equation (1), distance traveled by mail when the freight has reached $\frac{2}{3}x$ two-thirds of the journey.

$$\frac{2}{3}x - \left(\frac{3m-n}{3m}\right)x = \left(\frac{n-m}{3m}\right)x,$$ equation (2)—equal the distance apart of the trains when the speed of the freight is diminished one-half, or when it is $\frac{2}{3}$ of the distance.

Let us for convenience put equation (2)

$$\left(\frac{n-m}{3m}\right)x = v,$$

and let us call the distance to the point of collision beyond $\frac{2}{3}x = y$. Now as the speed of the freight is diminished one-half, we shall have:

$$\frac{v+y}{n} = \frac{y}{\frac{1}{2}m}$$

That is,

$$\frac{v+y}{2n} = \frac{y}{m}, \text{ and } 2ny - my = vm;$$

and hence

$$y = \frac{m}{2n-m}v.$$

Substituting for v its value in equation (2), we have

$$y = \left(\frac{m}{2n-m}\right)\left(\frac{n-m}{3m}\right)x = \left(\frac{n-m}{6n-3m}\right)x,$$ equation (3).

If now we add equations (1), (2) and (3), we shall have the distance from the beginning to the point of collision.

$$\left(\frac{3m-n}{3m}\right)x + \left(\frac{n-m}{3m}\right)x + \left(\frac{n-m}{6n-3m}\right)x = \left(\frac{2m}{3m} + \frac{n-m}{6n-3m}\right)x = \left(\frac{5n-3m}{6n-3m}\right)x,$$ equation (4).

If to equation (4) we add a, we shall have the total length of the railroad. Hence

$$x = \left(\frac{5n-3m}{6n-3m}\right)x + a. \quad \text{And } x - \left(\frac{5n-3m}{6n-3m}\right)x = a.$$

$$x = 1 - \frac{a}{\frac{5n-3m}{6n-3m}} = \left(\frac{6n-3m}{n}\right)a.$$

Substituting the value of x in equation (6) above, and reducing, we have

$$\left(\frac{6n^2-9mn+3m^2}{mn^2}\right)a$$

The distance is therefore

$$x = \left(\frac{6n-3m}{n}\right)a.$$

And the number of hours the freight started after the mail, which put equal to h.

We have

$$h = \left(\frac{6n^2-9mn+3m^2}{mn^2}\right)a.$$

If we put d = distance from the starting point to the point of collision we shall have

$$d = \left(\frac{5n-3m}{n}\right)a.$$

D. SHANAHAN.

Train Resistances on Curves.

At the meeting of the American Society of Civil Engineers, May, 15, W. Milnor Roberts in the chair, a paper was read on the "Resistances of Railroad Trains," by S. Whinery, who proposed a new formula for the elevation of the outer rail on curves, the results of which coincide very closely with the old tabular elevations for flat covers and low velocities, but call for less elevation for sharp curves and high velocities.

He also gave a theoretical discussion on coning wheels, in which he showed that with the ordinary cone of wheels the wheels should go around a 3° 30′ curve without flange friction.

Mr. E. P. North called attention to the fact that in the case of a truck with the axles parallel the advance would be in a straight line even if the wheels on one side were decidedly smaller than those on the other.

Mr. Emory said that some of the resistances to be met on curves were not taken account of by the author, gave his theory of curve resistances, and explained some of the anomalous results obtained by the Dudley dynograph.

Mr. Roberts spoke of the advantages of parabolic curves and discussed the advantages of different modes of commencing the elevation of an outer rail. Mr. C. L. McAlpine spoke of a curve used at Petersburg, Va., with a radius of only 40 feet. A large amount of army stores were transported over this curve, hauled by ordinary engines.

The further discussion of the paper was postponed till the meeting of June 5, when Mr. O. Chanute is expected to read a paper discussing Mr. Becker's paper on the Madison Inclined Plane.

THE SCRAP HEAP.

The Sleeping Car was Full.

He got on the train at Colfax, and, walking into the sleeping car, pulled out $2, and demanded of the African a lower berth.

"All full, sah."

"Lower berths all taken? Well, I'm develish sleepy; I'll take an upper berth; but it's a pretty note that a man can't get a lower berth on this road. Here, chuck that sack into some safe place, and be careful and not smash the bottle in the top. Take this money, quick, and get the bed ready."

"De lower berths is all full, sah, and so is de upper. Eberyting was 'gaged, sah, before we left Sacramento. Ye se—"

"The h—— you say!"

When the man finished blowing off his steam he bounced out into the other car, slammed down his valise, and woke up another man who was snoozing in his seat, to tell him that the sleeper was full. The other man informed him that he knew all about that four hours before.

The disappointed passenger then put his carpet-sack under a seat, and composed himself to slumber by running his knees as high up on on the back of the next seat as possible, while he slid down on his own seat as low as he could, until the back of his head rested on the top of a brass screw which was used in the upholstery. In this position his body assumed the form of a letter N turned upside down. At first he imagined he could rest forever in this comfortable position, and dropped off to sleep.

The conductor came along soon and woke him up for his ticket. He was under considerable obligations to the conductor for waking him up, as he did, for he found that his joints were getting stiff, and another fifteen minutes of it would have crippled him for life.

He next put his sack at the end of the seat and used it for the end of a pillow. When he laid down his head on the carpet-sack his cheek became smeared with a fresh quid of juicy tobacco which the sack had picked up from the floor. He then remarked "—— —— ——!" a few times, removed the tobacco, and coiled himself up for a nap.

He was in good position, and his feet stuck through the end of the seat and hung into the aisle. Presently a man got up to get a drink, and he had to move the obstruction by pulling them through the ornamental work and holding them in the air until the man got his drink and went back. By the time seventeen other passengers had drank, he concluded his position might be improved, and asked a brakeman to turn two seats facing each other. The brakeman said he couldn't. He had the same luck with a baggage-master and a newsboy. He then tried to pick the lock with his knife, and broke four blades out of six in eleven minutes.

At length the conductor came along and fixed the seat. He then endeavored to sleep by putting his heels in one seat and his head in another. The seat got the best of the bout in ten minutes. He then placed his carpet-sack between the seat and sat down on it, with his legs on the top of the seat ahead, and his head laid back on the seat behind. The seats won this round in twelve seconds. He then took the cushions and stretched them on the frames of the seats parallel with the cars.

When he coiled himself up in this position he thought it was a veritable "Dream of the Alhambra," and in three minutes he was asleep, and in four he thought he had just been elected to Congress from his state by an overwhelming majority. Then he dreamed he was lost on an iceberg in the Polar seas, and woke up to find that a man who had got off at Verdi had left the door open, and the cold air of the mountains was pouring in on him. He tried to warm up with a drink, but found his bottle smashed, at which he remarked as formerly: "——," and walked up and down the car, repeating it every ten minutes until he reached Reno. Next time he travels in the night he says he will engage a sleeper a month ahead.—*Virginia (Nev.) Chronicle.*

A Crooked Road.

The Olean, Bradford & Warren Railway must be a very crooked affair, or else some of our good temperance men here do not tell perpendicular stories. They sat on a dry-goods box in front of Frank Stevens' store talking of new railroads, and the aforesaid road was mentioned in the following complimentary manner:

No. 1—Why it's so crooked that the train ran around a telegraph post twice.

No. 2—Worse than that, it is so crooked that the passengers can see the backs of their heads.

No. 3—Pshaw, you fellows didn't notice the curves; why it's so bad that the engineer has to run her like hell to keep the rear car out of the engine's way.

That was too crooked even for us, and we immediately invited the boys to take "somethin' straight."

P. S.—None but a Brooks locomotive can run on that road.—*Dunkirk (N. Y.) Journal.*

Fast Time.

The Detroit *Post and Tribune* of May 25 says: "Mr. Forbes and several other directors of the Chicago, Burlington & Quincy road, who reside in Boston, came over the Michigan Central at 4 o'clock yesterday morning, and intended to continue their homeward jou. ney without delay, but through some mistake their car was switched off in the yard and left behind. For their accommodation a special train was made up and left Windsor at 9:15 a.m., five hours behind the Atlantic express. The trip to Suspension Bridge, a distance of 229 miles, was accomplished in 4 hours and 5 minutes actual running time, although 50 minutes must be added for delays. The Atlantic express was overtaken at the Bridge, and the travelers were enabled to continue their trip without further delay. They telegraphed back their thanks and acknowledgments to Passenger Agent Firth, and complimented the road in the highest terms."

LOCOMOTIVE RETURNS, FEBRUARY, 1878.

Master Mechanics of all American railroads are invited to send us their monthly returns for this table.

Name of Road.	Mileage. Number of miles operated	Mileage. Number of Locomotives in service	Mileage. Total	Mileage. Average per Engine.	No. Miles run to Ton of Coal	No. Miles run to Cord of Wood	No. Miles run to Pint of Oil	Average No. of freight cars hauled	Average cost per freight car per mile, cents	Cost per Mile in Cents for Repairs	Fuel	Stores	Miscellaneous	Engineers, firemen and wipers	Total	Average Cost of Coal per ton	Average Cost of Wood per cord
																$	$
Allegheny Val., River Div.*	139	42	75,154	1,789	36.08	.....	26.35	20.70	1.079	7.84	3.72	0.49	.....	6.34	18.39	.....	.....
Low Gr'de Div.*	120	18	33,301	1,850	27.21	.....	20.33	18.50	1.041	4.63	4.35	0.66	.....	6.23	15.87	.....	.....
Atlantic & Great Western, 1st & 2d Divs	228	83	178,224	2,147	38.33	.....	17.67	13.60	.....	2.77	5.23	0.52	0.80	5.88	15.20	1.88	2.80
3d & 4th Divs	197	48	127,307	2,652	32.28	.....	21.77	20.20	.....	4.55	5.39	0.41	0.67	5.52	16.54	1.64	2.80
Mahoning Div	88	53	79,430	1,499	39.93	.....	20.89	15.50	.....	3.67	5.05	0.47	0.67	5.70	15.56	1.89	2.80
Atlantic & Gulf	343	21	56,875	2,708	.....	49.44	18.70	.....	.....	4.20	3.54	0.50	.....	6.99	15.32	.....	1.75
Cairo & Vincennes	157	11	22,985	2,089	39.00	.....	15.50	.....	.....	4.81	3.51	0.32	.....	5.35	13.99	1.34	.....
California Pacific	152	12	27,858	2,322	47.20	.....	20.99	.....	.....	10.35	12.94	0.54	0.63	7.70	32.16	6.00	5.75
Camden & Atlantic	67	12	15,675	1,306	61.26	.....	14.15	.....	.....	9.12	6.17	0.74	.....	5.77	21.80	3.70	.....
Cen. Pac., Western Div.†	227	55	126,276	2,296	50.18	.....	16.20	.....	.....	7.31	12.19	0.63	0.66	7.80	28.59	6.00	5.75
Visalia Div.†	157	10	22,749	2,275	49.63	.....	19.02	.....	.....	9.22	12.25	0.53	0.66	6.51	29.17	6.00	5.75
Tulare Div.†	171	9	21,712	2,412	59.40	.....	18.05	.....	.....	5.51	10.29	0.55	0.22	7.62	24.19	6.00	5.75
Los Angeles, San Diego, Yuma & Wilmington Divs.†	408	18	38,790	2,155	58.15	.....	15.90	.....	.....	5.17	10.54	0.63	0.33	8.07	24.74	6.00	5.75
Sacramento Div.†	120	33	62,873	1,905	..	29.59	15.81	.....	.....	4.97	19.43	0.71	0.59	9.66	35.36	.....	5.75
Oregon Div.†	152	8	20,025	2,503	....	40.29	21.35	.....	.....	10.92	14.27	0.48	0.25	7.84	33.76	.....	5.75
Truckee Div.†	205	24	58,854	2,452	36.57	29.73	16.65	.....	.....	3.70	17.88	0.60	0.53	8.54	31.25	6.00	5.75
Humboldt Div.†	201	19	43,517	2,290	46.24	.....	21.45	.....	.....	5.97	13.18	0.50	0.46	7.61	27.72	6.00	5.75
Salt Lake Div.†	219	28	59,397	2,122	32.57	.....	14.62	.....	.....	7.80	18.60	0.75	0.55	7.39	35.09	.....	5.75
Cleve., Col., Cin. & Ind., Columbus Div	138	57	145,020	2,544	37.89	72.39	29.73	.....	.....	3.88	4.98	0.55	0.65	5.92	15.98	1.75	3.50
Indianapolis Div	203	64	175,762	2,746	36.93	44.66	22.58	.....	.....	3.70	5.52	0.63	1.27	5.75	16.87	1.75	3.50
Cincinnati Div	130	33	77,685	2,354	39.04	.....	21.34	.....	.....	4.74	4.78	0.57	0.93	6.00	17.02	1.75	3.50
Cleveland & Mahoning Valley	41	6	13,176	2,196	48.80	.....	26.14	8.00	.....	2.16	3.98	0.28	1.29	5.80	13.51	1.79	2.62
Cleveland & Pittsburgh*	225	74	134,580	1,820	48.43	.....	17.00	15.10	1.052	4.12	2.76	0.54	2.55	6.53	16.50	1.15	3.24
Del., Lackawanna & Western, Bloomsburg Div.‡	80	21	38,610	1,839	.....	.....	30.64	.....	.....	4.53	.....	0.62	.....	5.42	10.57	.....	.....
Erie & Pittsburgh*	98	27	48,912	1,812	38.17	.....	17.94	15.90	1.013	3.27	4.38	0.54	2.17	6.52	16.88	1.67	1.67
Ill. Cen., Chicago Div.§	253	60	118,463	1,974	35.56	.....	15.24	19.69	.....	3.81	5.25	0.30	.....	6.00	15.41	1.75	4.20
South Div.§	231	38	70,768	2,144	35.29	.....	13.08	16.57	.....	4.97	5.24	0.34	.....	5.78	16.35	1.75	4.20
North Div.§	225	41	82,037	2,001	29.50	.....	12.61	14.65	.....	5.27	6.18	0.35	.....	5.77	17.60	1.75	4.20
Springfield Div.§	112	12	18,918	2,577	43.79	.....	11.48	10.48	.....	4.57	3.55	0.42	.....	5.41	13.97	1.75	4.20
Iowa Div.§	401	42	97,101	2,312	25.73	.....	14.45	11.81	.....	4.89	9.56	0.33	.....	5.99	20.79	2.60	4.90
Jeff'nville, Madison & Ind's*	226	39	80,918	2,075	41.43	33.56	12.93	17.83	0 990	4.08	6.39	0.52	2.15	5.69	18.83	2.50	2.20
Kansas Pacific	721	62	112,561	1,816	26.79	.....	11.86	.....	.....	8.61	13.83	0.46	.....	7.38	30.28	3.04	5.30
Kansas City, St. Jo. & Council Bluffs¶	271	31	88,622	2,859	45.20	.....	27.00	21.00	.....	3.20	6.30	0.40	.....	6.40	16.30	2.70	3.50
Lake Shore & Mich. Southern. Buffalo Div.**	....	89	179,644	2,018	33.21	.....	19.42	.....	.....	3.71	9.48	0.39	.....	5.84	19.44	3.05	5.69
Erie Div.**	....	113	221,681	1,961	33.02	.....	26.10	.....	.....	3.19	8.60	0.36	.....	5.71	17.86	2.72	5.43
Toledo Div.**	....	85	160,142	1,884	26.96	64.60	19.01	.....	.....	3.34	13.34	0.45	.....	5.67	20.82	3.12	4.08
Mich. Southern Div.**	....	208	393,744	1,892	34.24	60.15	22.85	.....	.....	4.14	9.93	0.33	.....	5.82	20.09	3.55	4.63
Little Rock, Miss. River & Tex.	100	4	6,547	1,637	.....	64.00	8.00	.....	.....	6.40	3.50	0.70	2.30	8.20	21.10	.....	2.25
Louisv'e & Nash., First Div.**	332	....	100,690	2,146	29.00	37.75	12.61	.....	.....	3.11	7.98	0.41	1.79	7.16	20.45	2.22	2.51
Second Div.**	200	...	72,346	2,146	26.00	.....	11.30	.....	.....	5.82	8.07	0.51	1.95	6.18	22.53	2.05	2.74
Memph. Div.**	131	....	31,099	2,146	33 25	.....	13.52	.....	.....	3.84	9.25	0.52	2.43	6.43	22.47	3.04	2.80
Nashville & Decatur Div.**	122	....	40,302	2,146	30.75	.....	12.87	.....	.....	3.37	8.92	0.61	2.08	6.21	21.19	2.70	3.00
S. & N. Alabama R. R.**	183	....	62,980	2,146	34.50	.....	12.63	.....	.....	5.37	7.25	0.67	1.20	6.21	20.70	2.25	2.00
Marq., Hought'n & Ontonagon	88	8	8,360	1,045	53.17	.....	24.02	14.50	.....	0.98	7.94	0.56	.....	6.32	15.80	4.00	.....
Northern Central, Elmira & Canandaigua Divs.	147	42	69,107	1,645	26.25	.....	20.00	.....	.....	5.55	7.05	0.65	.....	5.69	18.94	1.80	2.16
Penn., New York Div.††	120	117	258,652	2,211	30.85	.....	10.48	.....	.....	4.80	10.00	0.90	.....	.....	15.70	3.00	4.80
Amboy Div.††	154	40	69,335	1,733	51.67	.....	18.12	.....	.....	3.80	5.60	0.60	.....	.....	10.00	3.00	4.80
Belvidere Div.††	103	37	49,027	1,325	35.98	.....	13.44	.....	.....	5.20	8.50	0.70	.....	.....	14.40	3.00	4.80
Philadelphia Div.††	191	163	367,641	2,255	27.23	.....	13.09	.....	.....	2.90	4.70	0.60	.....	.....	8.20	1.20	2.72
Middle Div.††	132	93	268,223	2,884	27.18	.....	16.34	.....	.....	4.40	4.60	0.50	.....	.....	9.50	1.20	2.72
Pittsb'h Div ††	221	190	416,877	2,194	25.18	.....	12.11	.....	.....	3.40	4.90	0.60	.....	.....	8 90	1.20	2.72
Tyrone Div.††	107	33	52,174	1,581	22.03	.....	20.00	.....	.....	3.40	5.50	0.50	.....	.....	9.40	1.20	2.72
West Penn. Div.††	104	22	38,064	1,730	40.79	.....	34.25	.....	.....	2.60	3.10	0.30	.....	.....	6.00	1.20	2.72
Lewistown Div.††	56	6	8,559	1,427	30.32	.....	16.50	.....	.....	0.70	4.00	0.50	.....	.....	5.20	1.20	2.72
Bedford Div.††	57	4	5,080	1,270	44.98	.....	25.91	.....	.....	6.50	2.70	0.30	.....	.....	9.50	1.20	2.88
Pitts., Fort Wayne & Chicago, Eastern Div.*	371	150	391,521	2,610	40.49	.....	16.54	14.40	0.950	2.39	3.02	0.58	1.46	6.07	14.12	1.46	1.46
Western Div*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pitts., Cin. & St. Louis, Little Miami Div.*	197	37	85,554	2,319	37.54	.....	10.23	15.62	1.179	5.59	7.21	0.71	2.10	5.68	21.29	2.63	2.00
P., C. & St. L. Div.*	224	86	206,502	2,401	28.12	.....	20.10	18.05	0.920	6.23	3.45	0.49	2.16	6.00	18.33	0.90	2.50
St. Louis, Iron Mt. & So., Arkansas Div.	325	32	75,090	2,347	.....	34.70	14.70	.....	.....	3.60	7.48	0.46	.....	6.38	17.92	.....	2.60
St. Louis & San Francisco‖	328	....	57,216	.....	34.70	.....	16.00	.....	.....	3.68	6.00	0.35	.....	5.74	15.77	2.10	1.80
Stockton & Copperopolis	49	3	3,560	1,187	37.77	.....	14.41	.....	.....	1.50	16.55	0.97	0.80	9.92	29.74	6.00	5.75
West Jersey††	128	16	29,870	1,867	49.07	.....	20.83	.....	.....	6.00	7.40	0.50	.....	.....	14.50	3.60	3.89

* Five empty cars rated as three loaded ones.
† Switching engines allowed 6 miles per hour; helping engines, actual distance run and 4 miles per hour while waiting trains.
‡ Fuel not estimated. § Two empty cars rated as one loaded one.
‖ Switching and work-train engines allowed 6 miles per hour; no switching mileage allowed to train engines.
¶ Three empty freight cars rated as two loaded ones. ** Switching engines allowed 6 miles per hour.
†† Engineers', firemen's and wipers' wages not included in cost per mile run.
The ton of coal is 2,000 lbs., unless otherwise noted; 25 bushels counted to the ton.

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EDITORIAL ANNOUNCEMENTS.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

A STANDARD CAR AXLE.

Most of our readers who are interested in the meeting of the Master Car-Builders' Association are probably aware that the annual convention will be held at Niagara Falls, beginning Wednesday, June 12. The meeting promises to be a very successful one, and all reports indicate that the attendance will be larger than ever before.

The subjects proposed for consideration, and which committees have been appointed to report on are: 1. Train Brakes for Freight Cars; 2. Substitution of Steel for Iron and Iron for Wood in Car Construction; 3. Inspection and Small Repairs of Freight Cars; 4. Improvements in Cars during Current Year; 5. Decrease of Dead Weight in Passenger and Freight Cars; 6. Standard Car Axle.

The committee on the latter subject was appointed, as the printed report says, "to gather all the information possible, and to report at the next convention, as to whether it would be necessary to make any alteration in the standard axle." It is this subject alone which will now be discussed.

It was in 1873, at the meeting in Boston, that the present form and proportions for a standard axle were recommended. In 1875 the same subject was presented at the meeting of the Master Mechanics' Association held in New York, by a special report on it which was supplemented by the following resolution: "That his association concur with the Master Car-Builders' Association in recommending the adoption of the standard for car and tender axles which that association has proposed, when said axles are made of iron." The last clause of this resolution should be noted, because it was introduced in order to obviate the objection which ultimately defeated the resolution. At that time steel axles were, it may be said, just fairly coming into general use, and one of the arguments advanced in their favor was that, owing to the greater strength of steel, if axles were made of that material, they might be of considerably smaller size than would be necessary if made of iron. For this reason it was considered, as one member remarked during the discussion, "that it would be wise to have the question kept open a little longer," before adopting the resolution. The same member remarked that "if the members voted it down, it would not entirely end the matter." Although the report and the resolution were very fully discussed, the resolution was lost by a vote of 23 to 35. As intimated in the discussion, this did not necessarily end the matter. The only significance of the vote was, that those who defeated the measure were not sure that it was wise to adopt it *at that time*. The Association did not adopt any other form and proportions for a standard axle; it only declined *then* to recommend that proposed by the Car-Builder's Association. It could be brought up at any future time, certainly by any member voting with the majority, and by a new resolution by any member. This action was taken at the Richmond meeting of the Master Mechanics' Association. After the report on wheels and axles was read, a member suggested that some measures should be adopted with a view of recommending a standard for car and tender axles. The result was that a committee was appointed and instructed to confer with a similar committee appointed by the master car-builders, and to report at the next meeting. The way is therefore open to joint action of the two associations on this very important subject.

It may be said that this is very slight progress to make in five years on a subject of this kind; which is true, but in such cases where the very object aimed at is *agreement* of many people having diverse opinions, the progress will necessarily be slow.

To persons who have not followed the discussion, it may seem remarkable that a body of practical men are unable to agree upon so simple a matter as the form and proportions of a standard car axle. Those who have taken part in it can readily understand why this is so. When the subject was first discussed, those who took part in it, quite naturally, divided into two parties—the big-axle men and the little-axle men. These, as afterward appeared, became two irreconcilable factions. The little-axle men cling to past experience, forgetting the changed condition of things which made larger axles necessary, and oblivious in a great measure of the laws of friction which govern the whole subject. The consequence was that in the Master Car-Builders' Association there was one party in favor of an axle with a journal about $3\frac{1}{4}$ or $3\frac{1}{2}$ in. $\times$ 6 in. long, and another class in favor of one 4 in. diameter by 7 or 8 in. long. The standard determined upon, $3\frac{3}{4} \times 7$ in., was a compromise between these two parties, made with the hope that both would be reconciled. Possibly it would have been wiser if no such effort had been made, and if *two* standards had been recommended, one with journals $3\frac{1}{2} \times 6$ in. and another 4×8 in. The result would probably have been that the little-axle men would have used the first, and as late experience has shown, the progressive men would have used the larger one. One of the committees which reported on this subject gave a table in which, if our recollection is correct, there were seventy-two different standards given which were in actual use on railroads. If these could be reduced to *two* it would of course be a great step gained, but if all the railroads could agree on *one* standard it would be very much better.

It was also thought by some of the small-axle men that the decision in favor of the standard that was recommended was in a measure forced through the convention which decided upon it, and that it was not discussed as fully nor as freely as the importance of the subject demanded. The attitude in which the question now stands will give an opportunity to discuss it as thoroughly as may seem desirable. The disposition which was manifested at Richmond indicated that the members were prepared to consider the subject quite impartially, and the committee appointed is made up of big-axle men and little-axle men. It would seem desirable, too, to invite the Eastern and the Western Railroad Associations to send one or more experts to confer with the two committees with reference to this question. An agreement of a commission of this kind would, it is believed, insure the general adoption of whatever standard they might propose. It may seem to some readers that a great deal of talk and time has been devoted to this subject, much more than it deserves. It should be known, though, that a standard axle is the first and a requisite preliminary to the adoption of uniform patterns for the other parts of car trucks. A common pattern for journal bearings and journal boxes almost necessarily follows, and with uniform patterns for these parts, a standard truck can easily be designed.

The remarkable part about all this question is the unwillingness to take the first step which is so frequently manifested. We have now in this country over 60,000 miles of railroad with the common gauge of 4 ft. $8\frac{1}{2}$ in., over which cars pass from one line to another, and it is a daily occurrence to dispatch them from Boston to San Francisco—a distance of over 3,000 miles. In fact, cars are interchanged over this vast network of railroads, and therefore it would seem to be of the utmost importance that their construction should be such as would most facilitate their repair. Now, what do we find? Instead of uniformity, the greatest diversity. Even the screws and nuts made in one place will not fit those made in another. Every shop has a system of threads of its own; neither the number of threads to an inch, their form, nor the diameters of the screws agree, so that when repairs are needed often both the bolt and the nut must be removed and thrown away in order simply to replace a nut which has been lost.

The most casual observation will show that the parts of cars which are subject to the most wear, and which oftenest need to be replaced, are the journal bearings; and yet instead of having a common form for these, they are of almost endless variety, and at each station where through cars are inspected a perfect museum of different patterns of brass bearings must be kept on hand.

It is much easier, however, to point out an evil than to effect a cure. The roads with a common gauge have an enormous equipment, which will not be changed by any resolutions which any association may adopt. All that can be accomplished, therefore, in this direction, is for the different associations to coöperate and simply recommend a standard form and porportions for axles and other parts of cars. If this is done, then those roads which have no standard, or those which are disposed to change theirs, will be able to select one which has the authority of those associations which have or should have the most knowledge, if not the most authority, on such subjects.

It would be unfortunate if there should be any change from the decision made by the Car Builders' Association, and yet there can be no doubt that if after a full reconsideration of the subject the committees appointed should reiterate the conclusions of the Master Car Builders of five years ago, it would promote the introduction of that pattern of axle very much. It is, therefore, to be hoped that the whole subject will be very fully and impartially discussed, and that this discussion may be conducted with the idea constantly in view that what is to be aimed at is *unanimity*. It would be better to agree upon a poor standard than not to agree at all. Some of the members of both associations seem to have the opinion that by some process the best form and proportions for car axles must be absolutely determined. From the very nature of things this is impossible. The agreement must be very much like that of a jury which does not think alike. Personal predilections must be surrendered, in a great measure, and those who think they are infallible must, in such cases, give up to those who do not make any such claims.

The exhibition of human nature in this question has at times been amusing. There are men interested in this subject who are willing to admit that $3\frac{1}{2}$ in is the proper diameter for a standard car-axle journal, but who, it is verily believed, would submit to torture rather than agree to having it a quarter of an inch larger, These people are bent upon having a standard which is *absolutely right*, which means practically one that they think is right. As has been said before in deciding this question, agreement is what must be aimed at and not absolute rightness.

April Earnings.

Railroad earnings for April are reported in our table for 32 railroads with 16,255 miles of road, which is 524 miles, or 3.2 per cent., more than they worked last year. The aggregate earnings of these roads for the month this year were $7,791,074, which is 14.3 per cent. more than they were last year. The earnings per mile increased from $424 to $464, or 9.4 per cent.—a very large increase. The whole mileage reporting is about $20\frac{1}{2}$ per cent of the total in operation in the United States, but is hardly representative of it, very few of the Eastern roads reporting. Of the 32 reporting, 20 show an increase in earnings, and many of the increases are large, while most of the decreases are small. Among the increases are eight of more than 20 per cent., and five of more than 50 per cent., with several roads the change being from a season of unexampled dullness to one of unexampled activity in traffic.

There are reports from five roads that carry produce to Chicago. These had in the aggregate 5,182 miles of road last year and 5,306 this. Four of the five show an increase in earnings, amounting in the aggregate to 27.7 per cent. Seven roads, with 2,540 miles of road both years, carry produce to St. Louis. Two of these show an increase and the other five a decrease, and in the aggregate there is a decrease of 1.7 per cent.

Three of the roads belonging to the Southwestern Association report. During the month they were engaged in

a vexatious contest for the traffic of the Missouri River points. One of these shows a trifling increase in earnings and the other two small decreases. It is known that this traffic was exceptionally great in April; but for that knowledge, the fact of the railroad war would not be suspected from the reported earnings.

The largest increase in earnings are for the most part on the grain carrying roads, and chiefly on those which carry grain on the way to Lake Michigan.

For the four months ending with April—the first third of the year—we have reports from 31 railroads, which had in the aggregate, 16,305 miles of road, an increase over the mileage worked by them last year of 556 miles, or 3.5 per cent. The roads earned in the aggregate this year $29,546,296, which is 10.8 per cent. more than they earned for the corresponding four months in 1877. Their average earnings per mile of road increased from $1,694 to $1,812, or 7 per cent. Of the 31 roads reporting, ten show a decrease in earnings per mile. An increase of more than 20 per cent. is reported by nine roads, and the following enormous increases are reported by four roads: Burlington, Cedar Rapids & Northern, 66.8 per cent.; Burlington & Missouri River, in Nebraska, 64.1; Chicago, Milwaukee & St. Paul, 59.6; Southern Minnesota, 76.1.

Last year the average *decrease* in earnings per mile of 31 lines reported for April was 3.3 per cent., and, of 30 roads reporting for the four months, it was 7.7 per cent. This year, then, seems to have restored the roads about to the position of 1876, which, for the first few months of the year, was an unusually favorable one. For April, the results this year are much more favorable than in 1876.

Record of New Railroad Construction.

This number of the *Railroad Gazette* contains information of the laying of track on new railroads as follows:

Colorado Central.—The *Narrow-Gauge Division* is extended from Black Hawk, Col., to Central City, 4½ miles. It is of 3 ft. gauge.

Fort Dodge & Fort Ridgeley.—Track laid from Fort Dodge, Ia., north to Humboldt, 16 miles.

Toledo & Ann Arbor.—Completed by laying track from Dundee, Mich., southward to Toledo, O., and from the Macon River northward to Ann Arbor, 43 miles in all. It is of 3 ft. gauge.

Lehigh & Lackawanna.—Extended from Chapman, Pa., northeast to the Wind Gap, 10 miles.

This is a total of 73½ miles of new railroad, making 385 miles completed in the United States in 1878, against 393 miles reported for the corresponding period in 1877.

NEW YORK AND CHICAGO have just about kept pace with each other this year in grain business. From Jan. 1 to May 27 the figures have been, in bushels:

Chicago receipts	36,630,777
Chicago shipments	36,573,284
New York receipts	36,689,071

There is no particular significance in this coincidence. Chicago receipts are probably more thoroughly distributed than those of any other Northwestern market, and not especially likely to go to New York except when navigation is open. However, New York and Chicago receipts have usually not been very far apart, as will be seen by the following statement of them (not including flour) for the past six years:

	Chicago.	New York.
1872	81,532,779	75,025,915
1873	87,752,221	73,732,174
1874	83,611,658	86,321,263
1875	69,270,828	73,342,316
1876	83,437,096	75,005,775
1877	82,306,260	83,808,418
Total six years	488,910,842	467,235,861
Average	81,485,140	77,872,644

In three of the six years, as we see, Chicago receipts have exceeded New York receipts, and in the aggregate the former have been nearly 5 per cent. greater than the latter. Considering the fact that Chicago is a source of supply common to all the ports except New Orleans, and that within the six years there have been great changes in the amounts going to Philadelphia and Baltimore, it is somewhat remarkable that Chicago and New York receipts should have remained so nearly equal and so nearly the same. Chicago has once (1873) exceeded its average by 7¼ per cent., and has once (1875) fallen below it by 15 per cent.; but both the first and last years of the six show almost exactly average receipts. New York has once (1874) exceeded its average by 11 per cent., and once (1875) fallen below it by 6 per cent. From these figures (which, be it remembered, exclude flour) it is not possible to trace any general change in the grain traffic of either city. Indeed, they are to a great extent influenced by the same cause—the relation between rail and water rates. When water rates are much the lowest, Chicago attracts grain from a vast territory to the south of it, which has a rail outlet to the East much shorter than that to Chicago; when the rail rates are about as low as the water rates, it depends more on the district in its own latitude and to the north of it. New York's advantage by a difference in rates in favor of the lake and canal route need no explanation. But while this explains why the receipts of New York and Chicago should fluctuate together, it is no reason why they should be approximately the same in amount. That is apparently accidental.

THE TERMS OF THE KEOKUK & DES MOINES LEASE are announced this week in a circular of the directors to the stockholders, or at least they are partly stated. The present bonds of various kinds are all to be retired and to be replaced by a single issue of $2,750,000 5 per cent. bonds, guaranteed by the Chicago, Rock Island & Pacific Company, and therefore certainly good. The latter also is to pay $6,098 for 6,098 out of 15,240 shares of preferred stock, and $7,200 for 14,400 shares out of 24,000 shares of common stock, giving it 20,498 out of 39,240 shares of both kinds, which will enable it to control the company. The fixed charges of the Keokuk & Des Moines Company will, by this arrangement, be reduced to $137,500 per year, or less than $850 per mile of road, instead of $181,500, or $1,119 per mile, which is what the bonds now call for. Yet doubtless the new bonds guaranteed by the Rock Island will bear a much higher price in the market than the old ones with their higher rate of interest, which was not sure to be paid, and which, in fact, the company has not always earned enough to pay.

What is left indefinite by the circular as to the terms of lease is with regard to the rental. The circular says that a percentage of earnings is to be set aside, and all its surplus over interest is to be divided among the stockholders. The amount of rental depends largely upon this percentage, though it must be remembered that 40 per cent. of the dividends on the preferred stock and 60 per cent. of those on the common stock will go into the treasury of the Rock Island Company, as the owner of the stock.

Heretofore, we believe, even in the worst years, the net earnings of the Keokuk & Des Moines have been equal to the fixed charges under the proposed arrangement, which has yet to be consummated by vote of the stockholders and voting bondholders of the company. There is, we suppose, no doubt of their favorable action. Their securities will doubtless be materially increased in value by the lease to a company of such good credit.

THE GRAIN MOVEMENT is extraordinarily active, greatly to the advantage of the Northwestern railroads, which for the most part are getting remunerative rates for carrying. Farmers are now bringing to market their stocks, especially of corn, which latter they have had little opportunity to market heretofore, the grain not being in condition until late in the winter, and the roads being bad most of the time; and the very early spring demanded all the farmer's attention to preparing the ground for and putting in the new crops. That work is now done in most of the corn country, two weeks or more earlier than usual, and the interval before harvest, or what can be spared from cultivating the corn, is largely given to marketing what is left of last year's crops. This explains why the movement is extraordinarily heavy for the season, the grain coming forward in May which usually, however abundant, had to wait until June. The fact that the Northwestern receipts are now exceptionally large for any season of the year, exceeded, if at all, only during some fall months when the demand was pressing, is due doubtless to the fact that there is a great surplus in the country which the farmers are determined to be rid of, as they anticipate enormous crops again this year. But while the earliness of the season accounts for the present unusual activity, it will also probably compel an equally early suspension of shipments, when the harvest will require all the time of the farmers; and if the shipments from the Northwestern markets keep as close to their receipts as they have been heretofore this year, there is reason to expect more than the usual midsummer dullness. Hitherto stocks have not been permitted to accumulate at the Northwestern markets, where there is storage room for tens of millions of bushels. The grain has gone forward about as fast as it has come in, before as well as after navigation opened, and the stocks on hand have hardly equaled a week's shipments.

The railroads between the West and the Eastern seaboard are not profiting much by the heavy movement, as the rates by water are so low as to prevent the roads from getting a large share of the grain, and the rail rates are too low to leave them any profit or anything more than an exceedingly minute one. But it has been but seldom that these roads ever have made any considerable profit from this traffic in summer, so they can hardly be said to be losing anything. The grain traffic is and always has been chiefly important to the roads in the upper Mississippi valley, which do not have to pro-rate with the Eastern lines, but get a reasonable profit on the traffic. These—and they have a mileage several times as great as that of the roads from the Northwestern markets to the seaboard—are enormously benefited by a great grain movement.

LAKE AND CANAL RATES have both advanced a little during the past week, though the advance in lake rates is very little—about an eighth of a cent a bushel, and in some cases a quarter of a cent, perhaps, leaving the last quotations about 1⅛ cents per bushel for corn from Chicago to Buffalo and 2⅛ for wheat, with a pretty firm feeling which will perhaps result in another slight increase, as the amount going forward is enormous, and most of it goes by lake, in spite of the rate of 20 cents per 100 lbs. by rail. The advance in canal rates is more considerable, last Tuesday's quotations per bushel from Buffalo to New York being 5¾ cents for wheat, 5¼ for corn and 3¾ for oats, which is about half a cent higher all around. Vessel-owners complain of the low rates, and some of the smaller vessels are said to contemplate lying up for a time until they improve. But the very large vessels and the steam barges work as if they found some margin of profit in spite of the low rates. Apparently the small vessels are doomed for the grain traffic, and, what is important for the railroads to consider, the growing fleet of large carriers is likely to make the low lake rates of this and the previous two years, or something like them, the ruling rates in the future. There is no prospect whatever that the lake rates hereafter will ever reach (except perhaps in some emergency) the rates common before 1873, when sometimes the average for the whole season's business was 5, 6 or 7 cents a bushel. At present the large vessels seem to thrive on an average rate of 2 or 2½ cents a bushel, with 25 cents a ton for back cargoes of coal. The distance is nearly a thousand miles. The present corn rate is about 0.075 cent, and the coal rate less than 0.03 per ton per mile. The current rate from New York to Liverpool is about two-and-a-half times as high. In proportion to the distance the canal rate is more than five times as high as the lake rate. If grain could be carried through to the sea-board as cheaply as it is from Chicago to Buffalo, it would be worth but about three cents a bushel more in New York than in Chicago. The Canadians hope to approximate this by improving the Welland Canal, but the 400 miles from Lake Erie to Montreal will have some 35 miles of canal, which, though deep and wide, will not be equivalent to the open lake, and half of the rest will be river navigation, which may be as favorable for steamers, but not for sail vessels.

THE EAST-BOUND FREIGHT APPORTIONMENT, which went into operation March 11, was made for the period of three months, and it therefore expires June 11. There have been, we believe, very few transfers of freight under this scheme, to effect the agreed divisions of traffic; at least there are few places in which such transfers have been made; but reports of the traffic have been made and preserved, which will serve as a basis for transfers hereafter. As an apportionment scheme, the arrangement has hardly had a fair trial, rates not having been maintained more than half of the time; but the statistics kept are very valuable and will be available for many purposes, even if no apportionment is made hereafter. One of the most important things to know, when there is a contest over a given traffic, is the total amount of that traffic. Strange as it may seem, this often does not seem to affect the conduct of the parties to such a contest. I contend that your policy concerning shipments of black-walnut lumber from Woodville deprives me of my just share of the traffic; I retaliate, and the value of Woodville traffic in all freight, and of many other places also, is wholly destroyed. After having lost a hundred thousand dollars in our struggle, we agree to restore the *status quo ante bellum*, and paying rates are established again. Now, probably enough, the total yearly receipts for black-walnut lumber shipped from Woodville were less than $10,000. Such things happen, but it is hardly conceiveable that they could happen if you and I both knew beforehand just how much—or how little—the traffic is worth concerning which we do not agree. Now if nothing further comes of the present agreement, we may at least hope that the positive knowledge gained concerning the trifling value of certain kinds of traffic may prevent future disputes concerning that traffic; that if we are to have railroad wars over east-bound freight in the future they will be over traffic that is worth fighting for. For instance, there are probably some people who would have thought it worth while to enter into a costly struggle to prevent the diversion of high-class freights to the East. Now we understand that the reports showed that for several weeks the shipments of first and second class freight from Chicago averaged but about *one* full car-load daily, and that the first, second and third classes together were less than *two per cent.* of the total shipments. Knowing this, it is not probable that there will hereafter be any great trouble about this freight.

The troubles which disturbed this scheme for several weeks seem now to have ceased, for the most part, at least, and it would appear desirable to continue it after the expiration of the three months, so that it may have a fair trial. Nothing has been determined so far, but it seems to be the general impression that it will not be continued. A meeting of the companies which are parties to it will be held before the 11th. One was called for the 5th, but as not all the principal companies could be represented then, it was postponed.

THE ATLANTIC & GREAT WESTERN'S FUTURE has been a subject of speculation recently, and really somebody seems to have been paying some attention to it. English journals of May 18 note considerable purchase of and a sharp advance in the first-mortgage bonds, said to have been bought on American account. No recent steps have been taken with regard to carrying out the reconstruction scheme, which, indeed, seems now to be considered impracticable. A meeting is to be held in London, June 4, to consider a further report from the re-organization trustees.

THE CHICAGO & NORTHWESTERN ELECTION, which will be held next week, continues to attract a great deal of attention—more, we should say, than its importance demands. It seems to be commonly supposed that the management is likely to be revolutionized by a change in the directory. Now, the fact is, that under any circumstances the new directory will have two-thirds of its members from the old one; and it appears that there have been no differences of policy dividing members of the old board, that ever came to light; and the different parties now asking for proxies have not been able to assign any such difference as a basis of favor to one or exclusion of the other party. Moreover, as nearly as can be ascertained, the whole contest is as to the election of one man. His opponents do not object to his party, but to him; and are willing to accept any of his supporters in place of him. This is a sufficient indication that the contest is not concerning a policy. It is not at all probable that any marked change in management of the road will be made, whatever party may succeed at the next election It seems to be assumed by many that a party of stockholders cannot unite to get somebody in or keep somebody out of their directory without having some vast and mysterious object in view. In truth, stockholders are wonderfully like other people. They vote a man in sometimes because they like him;

and they vote one out sometimes simply because they don't like him.

The directors whose terms expire this year are Jay Gould, Harvey Kennedy, S. M. Mills and John Bloodgood, of New York; Wm. L. Scott, of Erie, Pa.; and J. L. Ten Have, of Amsterdam, Holland. Of these Mr. Gould was not elected by the stockholders, but was chosen a little more than a year ago by the directors to fill a vacancy caused by the resignation of the late John F. Tracy.

NEW PUBLICATIONS.

A Manual of Engineering Specifications and Contracts: designed as a text-book and work of reference for all who may be engaged in the theory and practice of engineering. By Lewis M. Haupt, Professor of Civil Engineering in the University of Pennsylvania.

The author of this book has bundled together 24 specifications of various structures, and appended to them a series of questions. Very many of the latter are not answered either in the specifications themselves or in the glossary of terms which is added. For instance, an page 69 a specification requires faces of cut stone to be bush-hammered. The corresponding question on page 203 is, "Define bush-hammered." In the glossary, a bush-hammer is defined as "a mason's large breaking hammer;" so that a student would infer that the top of the coping of a canal lock ought to be broken with a large hammer.

Again, on page 151, the specification for a railroad requires the timber on each side of the road to be *slashed* for a certain width. The corresponding conundrum is "Define *slashed*."

The glossary is discreetly silent.

To enumerate the absurdities in the questions and the glossary would be tiresome. Both bear unmistakable signs of having been prepared by a tyro in engineering. One definition in the glossary must not be overlooked, however.

It is "*Bonus;* a consideration; a premium or award offered for work completed before a certain time; *hence it has become the synonym for work which has been hastily and improperly done.*"

Another specimen of "cross questions and silly answers" may be found in comparing the sewer specification on page 98, which requires "bulls-eyes" for connection with branch sewers to be inserted, with the definition in the glossary: "*Bulls-eye*—a small round window or light: a lantern."

A slender rivulet of introductory matter to the extracts meanders through the book, and in the chapter on contracts enlarges into a pool of eight pages, purporting to be an abstract of the law of contracts. Many of the points enumerated are valueless. The only authorities quoted are the Prophet Jeremiah (whose rulings are not known to be accepted in our courts) and a ruling in a Philadelphia court on a point which has frequently been decided the other way.

Looking at this work as a "text-book," it is deficient in analysis of the requirements and forms of a specification and contract, and is incorrect in many points where it attempts to instruct. Looking at it as a "work of reference," it is of no value. The different forms of specifications given are not similar in their arrangement of items and conditions, and no clue is afforded as to what form is best. A book of instruction and reference should speak with authority, and not leave the person consulting it to decide for himself from a mass of conflicting statements.

As regards measurement of artisans' work, the statements are defective in that the localities where the different modes of measurement are practiced are not given. For instance, it is stated that brickwork is often measured by the *rod*, and that the dimension of the rod varies from 16½ square feet to 324 square feet; but no intimation is given where one might expect to find any one system in use.

The assertion is made that a cubic foot of brick work is assumed to contain 20 bricks, a cubic yard 600 bricks, and a perch of 22 feet 500 bricks. These assumptions are inconsistent in themselves and moreover are not true, for the bricks made in New Hampshire take 675 to the cubic yard, in Boston 594, in New York 575, in Washington 470, and in St. Louis 450.

That a book such as this claims to be is wanted, no engineer will deny. That this book supplies the want, no engineer of experience will acknowledge.

A Pocket Railroad Report is provided for by a very convenient blank form designed by Mr. Thomas D. Maurer, Auditor of the Texas & Pacific Railway. We gave some account of this form as it was originally designed by Mr. Maurer, simply for use on his own road. When the blanks for twelve separate months were bound together, they made a thick and heavy volume which few would find room for in a pocket. Now Mr. Maurer has had a form prepared for a single month, with a morocco case from which it can be removed at pleasure to make room for another form for another month. In this way a thin, light and flexible pocket-book is formed, while room is still kept for most of the figures which a railroad officer needs to enable him to know just what his road has been doing, in comparison with the previous year. The first form, covering two pages, is headed "Earnings and Expenses from All Sources." Three columns to the left are for the figures of the month, seven to the right of the titles for the part of the fiscal year ending with that month, two columns for the two years compared, and one for the increase or decrease, and, for the longer period, columns being given for the figures per mile of road marked and also per train mile. First, there is a consolidated statement in the three lines "Gross Earnings," "Operating Expenses," and "Net Earnings." Below eleven heads are given for earnings and five for expenses, with ten or twelve blank lines in which other heads may be written. By writing decreases with ink of a different color from that in which increases are written, the results can be more readily distinguished.

Then follows two pages of passenger and freight statistics, the statistics being for both traffic and revenue; two pages of "locomotive and car mileage statements," in which places are given for much very valuable information which we fear many companies could not fill, for lack of records. For instance, among the heads are those for the average number of cars and average cost per car per mile in both passenger and freight trains, and in both directions, and for freight trains the average numbers loaded and empty in both directions are called for. Then follow very full statements of expenses, "Conducting Transportation" under 32 heads, "Motive Power" under 23, "Maintenance of Cars" under 19, and "Maintenance of Way" under 12, with blank lines for more under each general head. The old forms gave columns for a division of expenses between passengers and freight; for these are substituted "labor" and "material" in the new one, which will be much more valuable to those who have to supervise the expenditures of a road. All items of expense are given per mile of road and per train mile, as well as in gross. The columns per train mile are substituted for those which were headed per cent. of increase and decrease in the original form.

The remainder of the book is chiefly occupied by statements of freight received and forwarded from each station, given under the several heads "general merchandise," "manufactures," "cotton," "grain," "flour," "miscellaneous," "agricultural products," "live stock," "animal products," "products of mines, etc.," "government freight," "contractors' freight," "construction," "railroad material," "company's service," "total for month" and "total," for the part of the fiscal year that has expired, compared with the corresponding part of the previous year. Under each of these heads both tons and revenue are given, and wonderfully little room is required for it, and reference to any item is made very easy. There are lines for 42 different stations. In many cases probably it would be preferable to give the figures only for the principal stations, and lump the others under "other stations," or "other stations on Blank Division," or "stations on Blank Branch." But as no names are printed for stations, entries can be made to suit the particular case, the object being to give the information that is needed and make it readily accessible and intelligible. A number of blank pages are given with room enough for a balance sheet, income account or whatever may be desirable, and special provision is made for a consolidated statement of some of the chief items of information for each month for three consecutive years.

The new form is general in its character—that is, it is made to be used on any road, and has no name of station or other thing—nothing printed on it which is peculiar to any special road. It seems very ingeniously designed to contain a great deal in a small space; and, so far as we are able to judge from a hasty examination, it seems to cover the ground extremely well, giving the information that is most desirable for an understanding of the course and conduct of a railroad's business. But even if it were not perfectly designed, its portability and the readiness with which it may be referred to would strongly recommend it to intelligent officers who desire to keep themselves thoroughly informed as to their business. Figures are not easily held in the head, and it often is extremely convenient to use them when the regular records are not immediately accessible. With such a pocket-book filled out to date, the railroad officer always has with him material for study which can be utilized on the road and at odd moments.

The Railway Enterprise is the title of a new monthly journal, published in Chicago by Mr. Day K. Smith, "devoted to the interests and welfare of all persons employed in the railway, steamboat, express and telegraph business." The prospectus announces that it is intended to be in many respects a general family paper, containing miscellaneous news and articles, as well as technical matter. The first number issued, for May, bears this general character. Mr. Smith is pretty well known as a railroad man, having been formerly Assistant Superintendent of the Toledo, Peoria & Warsaw Railway, and being at present Northern Passenger Agent of the International & Great Northern.

This reminds us that there has been published for some months in Toledo a journal of somewhat similar character, also a monthly, entitled *The Railroader*, which has given a good deal of personal news, published originally Mr. Leland's interesting history of the Lake Shore & Michigan Southern Railway, and has shown considerable judgment in selecting matter interesting to railroad employés.

Also, several numbers have appeared of another railroad monthly, the *Railway Purchasing Agent*, published in Chicago by the publisher of the Chicago *Railway Review*, and very largely devoted to the publication of the papers, discussions, announcements, etc., of the Purchasing Agents' Association.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings will be held as follows:

Chicago, Rock Island & Pacific, anhual meeting, at the office in Chicago, June 5.

Chicago & Northwestern, annual meeting, at the office in Chicago, June 6, at 1 p. m.

Chicago, Milwaukee & St. Paul, annual meeting, at the office in Milwaukee, June 8, at noon.

Grand Rapids, Newaygo & Lake Shore, annual meeting, at the office in Grand Rapids, Mich., June 20, at 2 p. m.

Dividends.

Dividends have been declared as follows:

Fitchburg, 3½ per cent., semi-annual, payable July 1.

Iowa Falls & Sioux City (leased to Illinois Central), 1 per cent., payable June 1.

Railroad Conventions.

The twelfth annual meeting of the *Master Car-Builders' Association*, will be held at Niagara Falls, N. Y., beginning Wednesday, June 12.

The Yardmasters' Mutual Benevolent Association will hold its annual convention in Chicago, June 5.

Foreclosure Sales.

The property of the *Baltimore, Philadelphia & New York* Company, consisting of the charter and a little right of way, was sold recently under foreclosure and bought for $75 by H S. DuPont and others connected with the Wilmington & Northern Company. The company was originally the Juniata & State Line, and was to build a line from Philadelphia to Baltimore with several long branches. It did little or nothing, however, except to issue some bonds, and make an agreement to consolidate with the Wilmington & Reading, which was never completed.

Future sales are noted as follows:

The *New Jersey West Line* road will be sold under foreclosure of mortgage at the Court House in Newark, N. J., June 29. The property will be sold in five parcels: 1. The franchise, right of way, etc., from Newark to the Delaware River, including the finished road from Summit to Bernardsville (20 miles) and the graded road-bed from Summit to Lyons Farms. 2 and 3. Two locomotives wth tenders and appurtenances. 4. Three gravel and six flat cars. 5. A lot of old and new rails, spikes, etc. The sale is under the first mortgage dated March 11, 1870, to Theodore F. Randolph and Benjamin G. Clark, Trustees.

The sale of the *New Jersey Southern* road did not take place May 24, as advertised. No other date has been set. It is said that the recent decision of the Court of Appeals, setting aside the Chancellor's decree as to certain claims, will make a new or amended decree of sale necessary.

ELECTIONS AND APPOINTMENTS.

American Society of Civil Engineers.—The following additions to the list of members are noted in the February Transactions (just published): Albert Noble, Assistant United States Engineer, Sault Ste. Marie, Mich., is promoted from Junior to Member. Capt. James C. Ponst, Corps of Engineers, U. S. A., Savannah, Ga., becomes Member. The The following are admitted as Juniors: Edmund Heyer, of Buffalo, N. Y.; Norman B. Kellogg, of San Francisco, Cal.; and Edward Prince, of Paris, France. Mr. C. P. Sandberg, of London, resigns as Member.

Atchison, Topeka & Santa Fe.—The new board has reëlected Thomas Nickerson, President; Wm. B. Strong, Vice-President and General Manager; E. Wilder, Secretary and Treasurer; George L. Goodwin, Assistant Secretary and Assistant Treasurer.

The meetings of the company's leased lines were held as follows: *Florence, Eldorado & Walnut Valley*, at Eldorado, Kan., May 15: Directors, T. P. Alexander, Florence, Kan.; T. B. Murdock, Ed. C. Ellet, A. L. Redden, Eldorado, Kan.; Joseph Nickerson, Thomas Nickerson, Alden Speare, I. T. Burr, F. H. Peabody, Boston; President, Alden Speare; Vice-President, T. B. Murdock; Secretary, A. L. Redden; Treasurer, Thomas Nickerson. *Kansas City, Topeka & Santa Fe.*—Election May 17: Directors, F. H. Peabody, Joseph Nickerson, Thomas Nickerson, B. P. Cheney, Alden Speare, C. W. Pierce, G. B. Wilbur, D. L. Lakin, A. J. Dull, J. E. Perley, J. R. Mulvane; President, F. H. Peabody; Secretary and Treasurer, Thomas Nickerson. *Pleasant Hill & De Soto.*—Election May 17: Directors, Joseph Nickerson, Thomas Nickerson, I. T. Burr, George H. Rea, D. L. Lakin, G. B. Wilbur, C. J. Paine, F. H. Peabody, L. G. Pratt; President, G. B. Wilbur; Secretary and Treasurer, Thomas Nickerson. *Wichita & Southwestern.*—Election May 17: Directors; M. Kohn, J. R. Mead, Wichita, Kan.; C. W. Jewell, D. L. Lakin, Topeka, Kan.; I. T. Burr, C. W. Pierce, Thomas Nickerson, Joseph Nickerson, A. Speare, F. H. Peabody, G. B. Wilbur, C. C. Burr, G. C. Lord, Boston; President, I. T. Burr; Secretary and Treasurer, G. L. Goodwin.

Boston, Concord & Montreal.—At the annual meeting in Plymouth, N. H., May 27, the following directors were chosen: Joseph P. Pitman, Laconia, N. H.; S. A. Dodge, Plymouth, N. H.; Warren Daniell, Franklin, N. H.; Samuel N. Bell, Manchester, N. H.; Peter Butler, John P. Spaulding, J. Thomas Vose, Boston. Messrs. Dodge, Spaulding and Daniell are new directors, succeeding A. H. Tilton, Joseph W. Lary and John L. Rix, who declined reëlection. The board elected J. Thomas Vose President, in place of John E. Lyon, deceased, and Joseph A. Dodge (heretofore Superintendent), General Manager.

Central Vermont.—Mr. Wm. G. Peck has been appointed Lost Freight and Car Agent, with office at White River Junction, Vt.

Chicago & Alton.—Mr. J. C. McMullin, long the General Superintendent of this road has been appointed General Manager.

Chicago, Burlington & Quincy.—At a meeting of the directors in Boston, May 27, Mr. J. M. Forbes was chosen President in place of Mr. Robert Harris, resigned, and Mr. Harris, who remains a member of the Board of Directors, was appointed Consulting Engineer, which position, it is expected, will require but little of his time. It is understood that the active executive of the road will be Mr. C. E. Perkins, the General Manager, who was President of the Burlington & Missouri River Railroad before the consolidation, and is now Vice-President and General Manager of the Burlington & Missouri River, in Nebraska, which is an important connection of the Chicago, Burlington & Quincy.

Mr. T. J. Potter has been appointed General Superintendent. He has been connected with the road for a long time, and for several years has been Division Superintendent at Burlington, Ia.

It is reported that Mr. C. W. Smith, now General Freight Agent, is to be made Traffic Manager, a new office for this company. His successor as General Freight Agent will be, it is said, Mr. J. S. Goddard, his assistant for some time past.

Connecticut Western.—At the annual meeting of the preferred stockholders in Hartford, May 21, the following directors were chosen: Joseph Toy, Simsbury, Conn.; A. H. Holley, Lakeville, Conn.; L. W. Cutler, Watertown, Conn.; D. S. Warner, Salisbury, Conn.; E. T. Butler, Norfolk, Conn.; C. J. Camp, Wm. L. Gilbert, George Dudley, Winsted, Conn.; C. T. Hillyer, T. M. Allyn, L. R. Merriam, H. S. Barbour, N. B. Stevens, Hartford, Conn.

The board elected C. J. Camp, President; C. T. Hillyer, Vice-President: E. R. Beardsley, Secretary; Wm. L. Gilbert, Treasurer.

Florida Central.—Mr. James S. McElroy has been appointed Master of Transportation; he will continue Master

Mechanic also. The office of General Superintendent is abolished.

Fort Dodge & Fort Ridgeley.—The officers are: President, W. H. Brown; Vice-President, G. W. Bassett; Treasurer and Superintendent, G. B. Pearsons.

Grand Rapids & Indiana and Pittsburgh, Fort Wayne & Chicago Railroads Mutual Benefit Association.—At the annual meeting in Fort Wayne, Ind., May 21, the following officers were chosen: President, Clark Snider; Vice-Presidents, J. M. Metheany, G. W. Kelker, Peter Scott; General Secretary, F. R. Weldon; Treasurer, T. Donovan; Executive Committee, Thomas J. Hutchinson, J. K. McCracken, S. D. Gage, John J. Deem, H. T. Hite; Auditing Committee, J. N. Neeley, T. J. Nixon, N. Sprong.

Illinois Central.—At the annual meeting in Chicago, May 29, the three directors, whose terms then expired, were re-elected, as follows: W. H. Gebhard, A. R. Van Nest, John Elliott, all of New York.

Jeffersonville, Madison & Indianapolis.—At the annual meeting, held May 20, the following directors were chosen: J. N. McCullough, Wm. Thaw, Thomas A. Scott, H. H. Houston, George B. Roberts, James L. Bradley, D. W. Caldwell, R. W. Thompson, Dillard Ricketts, S. H. Patterson, R. J. Bright, J. H. McCampbell, George S. McKiernan. The board reelected Thomas A. Scott, President; George S. McKiernan, Secretary and Treasurer. The road is leased to the Pennsylvania company.

Master Mechanics' Association.—Following its custom for several years past, the convention at Richmond last week postponed the election of officers for a year, thus continuing the present officers, who are: President, N. E. Chapman, Cleveland, O.; First Vice-President, Reuben Wells, Jeffersonville, Ind.; Second Vice-President, J. N. Lander, Concord, N. H.; Secretary, J. H. Setchel, Cincinnati; Treasurer, S. J. Hayes, Chicago.

Middletown, Unionville & Water Gap.—At the annual meeting in Middletown, N. Y., May 27, the following directors were chosen: Grinnell Burt, W. H. Clark, H. A. Wadsworth, J. N. Pronk, D. C. Dusenberry, H. R. Wilcox, W. H. Wood, M. S. Hayne, Oscar Dunn, H. R. Low, M. D. Stivers, George L. Denton, Asa Smith. The road is leased to the New Jersey Midland.

Missouri Pacific.—Mr. Charles G. Warner has been appointed Acting Auditor and Frank E. Fowler General Passenger Agent, in place of C. L. White and George H. Heafford, resigned.

Nashua, Acton & Boston.—At the annual meeting, held May 21, the following directors were chosen: J. C. Moulton, H. Parkinson, C. G. Sargeant, J. B. Clark, E. R. Brown, J. Fletcher, Jr., B. Saunders, S. M. S. Moulton, E. B. Hammond, D. Sargeant. The board elected J. C. Moulton President; J. B. Goodsell, Clerk. The road is leased to the Concord Company.

Pacific Mail Steamship Co.—At the annual meeting in New York, May 29, the opposition to the old management elected their entire ticket, as follows: Henry Hart, David S. Babcock, John Riley, Samuel L. Phillips, Wm. Remsen, Wilson G. Hunt, James O. Sheldon, Charles F. Livermore, John H. Mahony. Mr. Hart is the only old director. Mr. Babcock is to be President; he is now President of the Providence & Stonington Steamship Company. The controlling parties in the new board are wealthy New Yorkers, who are chiefly known as owners of most of the stock of the Third Avenue street road.

Passenger Conductors' Life Insurance Association.—At the annual meeting in Philadelphia, May 24, the following officers were chosen: President, Wm. Welsh, Marietta & Cincinnati; Vice-Presidents, John M. Short, Cincinnati, Hamilton & Dayton; A. H. Catlin, New York Central & Hudson River, and B. F. Sherman, Lake Shore & Michigan Southern; Secretary and Treasurer, Walter Lackey, Philadelphia, Wilmington & Baltimore; Managers, J. W. Clingan, Vicksburg & Memphis; J. B. Ridgeway, Baltimore & Ohio; George F. Lincoln, Boston & Providence, and C. W. Merrill, Pittsburgh, Cincinnati & St. Louis.

Peterboro.—At the annual meeting in Nashua, N. H., May 22, the following directors were chosen: James Scott, G. W. Gill, George Stark, John H. George, S. A. B. Abbott, Edward Spaulding. The board elected James Scott President; Gilman C. Shattuck, Clerk; John G. Kimball, Treasurer. The road is leased to the Nashua & Lowell.

Potomac, Fredericksburg & Piedmont.—The officers are: L. H. Richards, President; Charles Kennedy, Superintendent. Offices at Fredericksburg, Va.

Purchasing Agents' Association.—At the annual convention in New York, May 23, the following officers were chosen for the ensuing year: President, C. M. Higginson, Chicago, Burlington & Quincy; First Vice-President, C. W. Porter, Canada Southern; Second Vice-President, A. W. Sumner, Northern Central; Secretary and Treasurer, A. G. Thompson, St. Louis & Southeastern; Executive Committee, A. C. Armstrong, Lake Shore & Michigan Southern; W. C. Cuddy, St. Louis, Iron Mountain & Southern; George Tozzer, Indianapolis, Cincinnati & Lafayette; H. H. Elliott, Eastern, and E. P. Miller, Indianapolis, Bloomington & Western.

Springfield & Northwestern.—The directors of the new company have elected John Williams President; A. Orendorff, Secretary and Attorney; Henry Reman, Treasurer.

Suncook Valley.—At the annual meeting in Manchester, N. H., May 23, the following directors were chosen: Samuel N. Bell, Charles H. Carpenter, Martin V. B. Edgerly, Reuben L. French, Natt Head, Frederick Smyth, Lemuel B. Towle. The board elected S. N. Bell, President; M. Clark, Clerk; James A. Weston, Treasurer. The road is leased to the Concord Company.

Toledo & Ann Arbor.—At the annual meeting in Ann Arbor, May 25, the following directors were chosen: James M. Ashley, James M. Ashley, Jr., H. W. Ashley, Israel Hall, A. W. Hamilton, Joseph T. Jacobs, H. C. Waldron, Ann Arbor, Mich.; E. Barnes, J. A. Stowell, Dundee, Mich. The board elected James M. Ashley, President; A. W. Hamilton, Secretary; George L. Shorey, Treasurer.

United New Jersey.—At the annual meeting in Trenton, May 28, the following directors were chosen: Benjamin Fish, John G. Stevens, Robert F. Stockton, Trenton, N. J.; Ashbel Welch, Lambertsville, N. J.; Alfred L. Dennis, Newark, N. J.; Isaac W. Scudder, Jersey City, N. J.; Wm. Bucknell, Samuel Welsh, Philadelphia; John Jacob Astor, Hon. Hamilton Fish, Cambridge Livingston, Robert Lenox Kennedy, New York. The only new director is Mr. Kennedy, who replaces Hon. Nehemiah Perry. Mr. Wm. Patterson, of Perth Amboy, is State director.

Viroqua.—The directors of this new company are: Wm. F. Lendemann, J. M. Rusk, Viroqua, Wis.; Charles A. Hunt, Jefferson, Wis.; Thomas H. Wilcox, New Lisbon, Wis.

Worcester & Shrewsbury.—The following officers have been elected for the ensuing year: President, E. B. Stoddard; Clerk and Treasurer, E. D. Stoddard; Superintendent, J. F. Bigelow.

PERSONAL.

—Mr. George L. Barringer has resigned his position as General Superintendent of the Indianapolis, Cincinnati & Lafayette road, to take effect June 1. Mr. Barringer retires on account of continued ill health, and will take a trip to Europe, believing that the change will help him to recover. He has been connected with the road in various capacities for nearly 25 years, ever since its first construction.

—Mr. Wm. Henry, who died at his residence in Wyoming, Pa., May 23, aged 84 years, was one of the founders of the city of Scranton, and one of the first projectors of what is now the Delaware, Lackawanna & Western Railroad.

—Mr. Walton W. Evans, of New York, the well-known engineer, recently received through the Austrian Consul General at New York a beautiful gold medal, accompanied by a complimentary letter from the Emperor of Austria, in recognition of services rendered to the Austrian Government. Mr. Evans sailed from New York May 25 on a visit to Paris.

—Mr. Fred. J. Thomas, Paymaster of the Detroit & Milwaukee road, having been blessed by the addition to his family of a flonrishing pair of twins, the other officers of the road at once made up a purse and presented him with the finest double-barreled baby carriage that money could buy.

—The annual report of the Boston, Concord & Montreal Company contains the following reference to the late John E. Lyon:

"It is with deep pain and regret that the directors are compelled to officially announce to the stockholders the sad and tragic death of the late John E. Lyon, President of this Corporation, which occurred at the Pemigewasset House, in Plymouth, N. H., on the morning of the 11th of April last, caused by his clothing accidently taking fire, whereby he was so badly burned that his decease resulted before noon of the same day.

"Mr. Lyon's connection with the road commenced as a director in 1857; and upon the retirement of Hon. Josiah Quincy, the first President of the Corporation, in 1860, he was unanimously elected to fill that office. Mr. Lyon was a man of nervous temperament, but indefatigable, cautious, and circumspect in his business operations; and upon his assumption of the office of President he brought to the management of the relations of the road the same care, diligence, and untiring industry that he applied to his own private affairs. Without flattery it could be said that the present successful condition of the road is almost entirely due to his efforts, and the confidence with which he inspired his associates; to his enterprise and to the aid of his personal efforts, as well as to the foresight and capital which he furnished, is due the extension of the road from Littleton to Lancaster, and ultimately to the junction with the Grand Trunk Railway at Groveton in the town of Northumberland, and also the construction of the branch road extending from the Wing Road station to the base of Mount Washington. * * * * * * * *

"It had been a cherished wish of Mr. Lyon that in the future the road of which he had control should be extended to Colebrook, and ultimately to the line of the Dominion of Canada, at as early a day as the finances of the road would permit. In this purpose the directors of the road fully concurred, and although his death may temporarily delay the accomplishment of this object, they are still of the opinion that the best interests of the road, and of the whole northern section of the State of New Hampshire, require that measures shall be undertaken to forward the project as soon as the means at their command will admit, consistently with a due regard for the claims of the people and the interests of the stockholders."

—Mr. Cyrus W. Field has resigned his position as a director of the Wabash Railway Company. It is said that his reason was the refusal of the board to prosecute the parties who recently began suits against the company.

—Professor Henry Morton, of the Stevens Institute of Technology at Hoboken, N. J., has been appointed to the position in the Light House Board made vacant by the death of Professor Joseph Henry.

—George H. Heafford, General Passenger Agent, and Clinton L. White, Auditor, of the Missouri Pacific Railroad have resigned. The cause is not definitely known.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings for various periods are reported as follows:

	1877-78.	1876-77.	Inc. or Dec.	P. c.
Year ending March 31:				
Boston, Concord & Montreal	$654,272	$649,308 I.	$4,964	0.8
Expenses	453,172	457,377 D.	4,205	0.9
Net earnings	$201,100	$191,931 I.	$9,169	4.8
Earnings per mile	3,918	3,935 D.	17	0.4
P. c. of expenses	69.26	70.44 D.	1.18	1.7
Manchester & Lawrence	171,777	177,702 D.	5,925	3.3
Expenses	71,339	77,266 D.	5,927	7.7
Net earnings	$100,438	$100,436 I.	$2	.....
Earnings per mile	6,607	6,835 D.	228	3.3
P. c. of expenses	41.48	43.48 D.	2.00	4.6
Four Months ending April 30:	1878.	1877.		
Denver & R. Grande	$260,265	$180,582 I.	$79,683	44.1
Net earnings	91,007	77,773 I.	13,234	17.0
P. c. of expenses	65.10	56.93 I.	8.17	14.3
Philadelphia & Erie	804,604	878,568 D.	73,964	8.4
Net earnings	246,728	247,297 D.	2,569	1.0
P. c. of expenses	69.34	71.62 D.	2.28	3.2
St. L. & Southeast	340,635	328,452 I.	21,183	6.4
Net earnings	69,296	62,319 I.	6,977	11.2
P. c. of expenses	80.10	81.14 D.	1.04	1.3
Month of April:				
Philadelphia & Erie	$215,090	$225,827 D.	$10,737	4.8
Net earnings	65,817	62,586 I.	3,231	5.2
P. c. of expenses	69.40	72.38 D.	2.98	4.1
Scioto Valley	20,788	.....	.....	.....
Second week in May:				
Chi. & Alton	$87,175	$87,475 D.	$300	0.3
St. Louis, Iron Mt. & Southern	67,000	72,208 D.	5,208	7.2
Week ending May 17:				
Great Western	$77,840	$84,061 D.	$3,221	7.4
Week ending May 18:				
Grand Trunk	$160,377	$166,021 D.	$6,644	3.4

Coal Movement.

Coal tonnages for the week ending May 18 are reported as follows:

	1878.	1877.	Decrease.	P. c.
Anthracite	391,387	517,272	125,885	24.3
Semi-bituminous	61,930	68,679	6,749	9.8
Bituminous, Pennsylv'a.	32,309	35,253	2,944	8.3

Harned, Ogle & Co., of Philadelphia, have secured the contract for a year's supply of coal for the Boston & Albany Railroad. The contract is for 115,000 tons of Clearfield, on a basis of $2.80 per ton at Philadelphia, 20,000 tons to be delivered at Boston and 95,000 tons at Hudson or Albany.

Water Rates.

From San Francisco charters of wooden sailing vessels for wheat to Liverpool are reported 47s. 6d. to 50s. per ton. No charters of iron vessels are reported. There were in port May 18 vessels under charter having a capacity of 18,202 tons, while 30 ships, of 39,500 tons capacity, were waiting for charters.

Railroad Traffic.

Shipments of through freight east over the Central Pacific in April were: From San Francisco, 2,980 tons; interior points, 310 tons; total, 3,290 tons.

Grain Movement.

For the week ending May 18 receipts and shipments of grain of all kinds for the past five years have been, in bushels:

The receipts of eight Northwestern markets were:

1878.	1877.	1876.	1875.	1874.
4,896,119	2,506,649	2,622,020	2,280,422	3,830,515

This year's receipts exceed those of last year by 96 per cent. They are larger than for any week since last October.

The shipments of the above markets were:

1878.	1877.	1876.	1875.	1874.
4,115,751	1,997,738	3,618,474	2,416 771	4,110,859

The shipments for the week this year were 106 per cent. greater than those of the corresponding week last year. The shipments are smaller than for the two preceding weeks.

The portion of the above shipments which was shipped by rail and its percentage of the total for each of the five years was:

1878.	1877.	1876.	1875.	1874.
1,866,111	758,450	2,016,304	850,929	904,240
45.6 p. c.	37.9 p. c.	55.7 p. c.	35.2 p. c.	22.0 p. c.

The rail shipments are very large this year, and a larger proportion of the total than in any previous year except 1876.

For most of the week the railroads were cutting rates, and 15 to 18 cents per 100 lbs. from Chicago to New York were reported to be the rates received. On the 16th, 20 cents became the regular rate.

The receipts of grain at the seven Atlantic ports for the same week were:

1878.	1877.	1876.	1875.	1874
6,359,345	2,575,025	3,941,860	1,891,558	3,492,0.2

This year, of the total receipts of the week 46.9 per cent. arrived at New York, 16.2 at Philadelphia, 12.7 at Baltimore, 8.5 at Montreal, 7.8 at Boston, 7.4 at New Orleans, and 0.5 at Portland.

The total receipts this year are 147 per cent. greater than those of the corresponding week last year. The week's receipts are the largest we have ever recorded except once. One week last October the receipts were a few thousand bushels more.

The movement now is chiefly in corn, though wheat shipments are large. This heavy movement in corn is favorable to Philadelphia and Baltimore; actually we find that the Philadelphia receipts for the week are the largest of the year and have been exceeded but once before this year. New York receipts are much smaller than the previous week, but larger than in any other week this year. The large rail movement from the West for the past few weeks is favorable to the other cities, and if continued will doubtless prevent the diversion to New York of so great a proportion of the grain as it had been getting since the arrivals by canal begun—55.7 per cent. one week, 65.0 per cent. the next, and now 46.9 per cent., against an average of 41.7 per cent. while navigation was closed.

Receipts and shipments at Chicago and Milwaukee for the week ending May 27 were:

	Receipts.	Shipments.
Chicago	3,765,658	3,112,282
Milwaukee	719,800	680,500

At Buffalo for the same week the receipts and shipments were:

	By water.	By rail.	Total.
Receipts	1,136,003	632,500	1,768,503
Shipments	2,058,747	1,030,290	3,089,037

The percentage of receipts by rail was 36; of shipments, 33⅓.

For the same week the receipts at four seaboard ports were: New York, 3,288,383 (56.8 per cent. of the whole); Philadelphia, 1,316,700 (22.7 per cent.); Baltimore, 837,581 (14.5 per cent.); Boston, 350,380 (6 per cent. of the total of 5,793,044 bushels received at these four ports during the week). Of the receipts at New York, 28 per cent. were by rail.

Transporting Beef.

The work of transporting fresh meats from the West to Philadelphia in refrigerator cars is meeting with continued success. Yesterday the Red Line Transit Company brought into Bradley's market an Anderson refrigerator car containing 114 quarters of fresh beef. The actual time from Chicago was sixty-four hours, which has not been excelled. The route was via Lake Shore, New York Central, Lehigh Valley and Reading railroads into Philadelphia. The beef reached the city in fine condition, and was consigned to Washington Butcher's Sons. The agent of the Red Line, Mr. W. D. Crane, expresses satisfaction at the success of the shipment.—*Philadelphia Times, May 23.*

RAILROAD LAW.

Railroad Leases in Connecticut.

The following law was passed by the Legislature of Connecticut at its last session:

"No lease of any railroad hereafter made shall be binding on either of the contracting parties for a period of more than twelve months unless the same shall be approved by the stockholders of the company or companies that are parties to the lease by a vote of two-thirds of the stock represented in person or by proxy at a meeting of the stockholders called for that purpose, and at least one month's notice shall be given of such meeting by advertising twice a week for four weeks in a daily paper published in this state, and also by mailing a copy of the call and of the lease to each stockholder, and said notice and call shall state that at the meeting the lease will be submitted for the approval of the stockholders."

Killing Stock.

In Caudle against the Indianapolis, Peru & Chicago Company, the Indiana Supreme Court lately held as follows:

Where a railroad company cannot legally fence its road, it will not be liable for stock killed in the absence of negligence, and where there is contributory negligence on the part of the party suing. Not having founded his action upon the statute it was necessary for the plaintiff to aver and prove that the killing was done without fault on his part.

In Thomas against the Baltimore, Pittsburgh & Chicago Company, the same Court held:

RAILROAD EARNINGS IN APRIL.

NAME OF ROAD.	MILEAGE.					EARNINGS.					EARNINGS PER MILE.	
	1878.	1877.	Inc.	Dec.	Per c.	1878.	1877.	Increase.	Decrease.	Per c.	1878.	1877
Atchison, Topeka & Santa Fe..	786	711	75	.....	10.5	$290,500	$200,681	$89,819	.....	44.9	$370	$282
Burl'gton, Ced. Rapids & North.	424	368	56	.....	15.2	115,277	72,435	42,842	.....	59.2	272	197
Bur. & Mo. River in Nebraska..	240	240	.....	.....	.....	131,497	75,100	56,397	.....	75.1	548	313
Cairo & St. Louis	146	146	.....	.....	.....	18,190	19,460	.....	$1,270	6.5	125	133
Central Pacific	1,878	1,660	218	.....	13.1	1,510,000	1,438,659	71,341	.....	5.0	804	867
Chicago & Alton	678	678	.....	.....	.....	330,613	339,384	.....	8,771	2.6	488	501
Chicago, Milwaukee & St. Paul.	1,414	1,402	12	.....	0.9	785,000	514,783	270,217	.....	52.5	555	367
Chicago & Northwestern	1,993	1,993	.....	.....	.....	1,108,369	867,603	240,766	.....	28.9	556	435
Cleveland, Mt. Vernon & Del..	157	157	.....	.....	.....	32,322	31,566	756	.....	2.4	206	201
Dakota Southern	78	78	.....	.....	.....	19,589	18,806	783	.....	4.2	251	241
Denver & Rio Grande	304	269	35	.....	13.0	80,773	49,323	31,450	.....	63.8	266	183
Detroit & Milwaukee	189	189	.....	.....	.....	77,364	76,636	728	.....	1.0	409	405
Illinois Central, Illinois lines..	819	707	112	.....	15.8	404,914	328,959	75,955	.....	23.1	494	465
" " Iowa lines	402	402	.....	.....	.....	118,438	101,598	16,840	.....	16.6	285	253
Indianapolis, Bl'm'gton & West.	343	343	.....	.....	.....	94,424	111,179	.....	16,755	15.1	275	324
International & Great Northern	516	516	.....	.....	.....	79,143	79,244	.....	101	0.1	153	154
Kansas Pacific	673	673	.....	.....	.....	270,408	258,198	21,270	.....	8.2	415	384
Missouri, Kansas & Texas	786	786	.....	.....	.....	206,796	221,657	.....	14,861	6.7	263	282
Missouri Pacific	426	426	.....	.....	.....	334,535	332,169	2,366	.....	0.7	785	780
Mobile & Ohio	527	527	.....	.....	.....	115,325	97,037	18,288	.....	18.9	219	184
Nash'lle, Chattan'ga & St. Louis	349	341	8	.....	2.3	128,469	126,372	2,097	.....	1.7	368	371
Paducah & Elizabethtown	185	185	.....	.....	.....	22,841	25,614	.....	2,773	10.8	123	138
Paducah & Memphis	115	115	.....	.....	.....	14,109	12,272	1,837	.....	15.0	123	107
Philadelphia & Erie	288	288	.....	.....	.....	215,090	225,827	.....	10,737	4.8	747	785
St. Louis, Alton & Terre Haute, Belleville Line	71	71	.....	.....	.....	35,717	36,571	.....	854	2.3	503	515
St. Louis, Iron Mt. & Southern.	685	685	.....	.....	.....	287,200	287,903	.....	703	0.2	419	420
St. Louis, Kansas City & North'n	530	530	.....	.....	.....	248,522	264,438	.....	15,916	6.0	469	499
St. Louis & San Francisco	328	328	.....	.....	.....	82,218	96,718	.....	14,500	15.0	251	295
St. Louis & Southeastern	354	354	.....	.....	.....	87,940	75,512	12,428	.....	16.5	248	213
Southern Minnesota	170	170	.....	.....	.....	59,900	31,000	28,900	.....	93.2	352	182
Toledo, Peoria & Warsaw	237	237	.....	.....	.....	90,627	90,113	514	.....	0.6	382	380
Wabash	688	680	8	.....	1.2	385,904	389,830	.....	3,926	1.0	561	573
Totals	14,779	16,255	524	.....	.....	$7,791,074	$6,896,647	$985,594	$91,167	.....	$464	$424
Total increase	.....	.....	524	.....	3.2	.....	.....	894,427	.....	14.3	.....	.....

RAILROAD EARNINGS, FOUR MONTHS ENDING APRIL 30.

NAME OF ROAD.	MILEAGE.					EARNINGS.					EARNINGS PER MILE.				
	1878.	1877.	Inc	Dec	P.c.	1878.	1877.	Increase.	Decrease.	P. c.	1878.	1877.	Inc.	Dec.	P. c.
Atchison, Top. & S. Fe.	786	711	75	....	10.5	$955,983	$661,025	$294,958	.....	44.6	$1,216	$930	$286	.....	30.8
Burlington, Ced. Rapids & Northern	424	368	56	....	15.2	553,026	287,687	265,339	.....	92.2	1,304	782	522	.....	66.8
Bur. & Mo. River in Nebraska	240	240	....	....	....	482,820	294,293	188,527	.....	64.1	2,012	1,226	786	.....	64.1
Cairo & St. Louis	146	146	....	....	....	60,958	80,424	.....	$19,466	24.2	418	551	....	$133	24.2
Central Pacific	1,878	1,660	218	....	13.1	4,833,410	4,799,819	33,591	.....	0.7	2,574	2,891	.....	317	10.9
Chicago & Alton	678	678	....	....	....	1,289,350	1,361,493	.....	72,143	5.3	1,902	2,008	.....	106	5.3
Chicago, Mil. & St. Paul.	1,407	1,402	5	....	0.3	2,822,000	1,762,788	1,059,212	.....	60.1	2,006	1,257	749	.....	59.6
Cleveland, Mt. V. & Del.	157	157	....	....	....	120,403	113,137	7,266	.....	6.4	767	721	46	.....	6.4
Dakota Southern	78	78	....	....	....	67,117	49,377	17,740	.....	35.9	860	633	227	.....	35.9
Denver & Rio Grande	304	269	35	....	13.0	260,264	180,582	79,682	.....	44.1	856	671	185	.....	27.6
Grand Trunk	1,389	1,389	....	....	....	2,908,959	2,841,414	127,545	.....	4.5	2,138	2,046	92	.....	4.5
Great West. of Canada	511	511	....	....	....	1,504,757	1,288,393	216,364	.....	16.8	2,945	2,521	424	.....	16.8
Illinois Cen., Ill. lines	819	707	112	....	15.8	1,657,051	1,418,350	238,701	.....	16.8	2,023	2,006	17	.....	0.8
" Iowa lines	402	402	....	....	....	501,479	409,088	92,391	.....	22.6	1,247	1,018	229	.....	22.6
Ind., Bloom. & Western	343	343	....	....	....	426,253	386,997	39,256	.....	10.1	1,243	1,128	115	.....	10.1
International & Gt. Nor.	516	516	....	....	....	429,842	502,585	.....	72,743	14.5	833	974	....	141	14.5
Kansas Pacific	673	673	....	....	....	926,487	845,841	80,646	.....	9.4	1,377	1,257	120	.....	9.4
Missouri, Kan. & Tex.	786	786	....	....	....	841,489	941,503	.....	100,014	10.6	1,071	1,198	.....	127	10.6
Missouri Pacific	426	426	....	....	....	1,272,662	1,93,541	79,121	.....	6.6	2,987	2,802	185	.....	6.6
Mobile & Ohio	527	527	....	....	....	741,862	642,499	99,363	.....	15.5	1,408	1,219	189	.....	15.5
Nashville, Chat. & St. L.	349	341	8	....	2.3	605,303	564,908	40,395	.....	7.2	1,734	1,657	77	.....	4.6
Paducah & Memphis	115	115	....	....	....	66,732	57,275	9,457	.....	16.5	580	498	82	.....	16.5
Philadelphia & Erie	288	288	....	....	....	804,604	878,568	.....	73,964	8.4	2,794	3,051	.....	257	8.4
St. Louis, Alton & T. H. Belleville Line	71	71	....	....	....	148,311	168,180	.....	19,869	11.8	2,089	2,369	.....	280	11.8
St. Louis, Iron Mt. & So.	685	685	....	....	....	1,348,237	1,368,291	.....	20,054	1.5	1,969	1,997	.....	28	1.5
St. Louis, K. C. & Nor.	530	530	....	....	....	1,047,089	1,014,210	32,879	.....	3.2	1,976	1,914	62	.....	3.2
St. Louis & San Fran.	328	328	....	....	....	361,516	415,647	.....	54,131	13.0	1,102	1,267	.....	165	13.0
St. Louis & Southeast'n	354	354	....	....	....	349,635	328,452	21,183	.....	6.4	988	928	60	.....	6.4
Southern Minnesota	170	170	....	....	....	238,667	135,494	103,173	.....	76.1	1,404	797	607	.....	76.1
Toledo, Peoria & War.	237	237	....	....	....	424,816	333,482	91,334	.....	27.4	1,792	1,407	385	.....	27.4
Wabash	688	641	47	....	7.3	1,435,214	1,348,876	86,338	.....	6.4	2,086	2,104	.....	18	0.7
Totals	16,305	15,749	556	....	....	$29,546,296	$26,674,219	$3,304,461	$432,384	.....	$1,812	$1,694	$118	.....	7.0
Total increase	.....	.....	556	....	3.5	.....	.....	2,872,077	.....	10.8	.....	.....	.....	.....	.....

The statute enlarges the common law liability of railroads for killing stock. But the owner of stock, when he founds his claim upon the statute, must bring his case substantially within its terms, by alleging and proving that the stock was "killed or injured by the locomotive, cars or other carriages of such company." Railroad companies are not liable for frightening animals by their locomotives, cars or carriages, even though the fright causes the animals to kill themselves.

Liability of Carrier.

In Pratt and others against the Grand Trunk Company, the United States Supreme Court lately held as follows:

1. The liability of a common carrier commences when the goods are delivered to and accepted by him, or his authorized agent, for transportation.

2. If a common carrier agrees that property intended for transportation by him may be deposited at a particular place without express notice to him, such deposit amounts to notice, and is a delivery.

3. The liability of a carrier is fixed by accepting the property to be transported, and the acceptance is complete whenever the property thus comes into his possession with his consent.

4. If the deposit of the goods is a mere accessory to the carriage, that is, if they are deposited for the purpose of being carried, without further orders, the responsibility of the carrier begins from the time they are received; but when they are subject to the further order of the owner, the case is otherwise.

THE SCRAP HEAP.

Railroad Manufactures.

Wilson, Brothers & Co., of Philadelphia, have a contract to design and to superintend the construction of all the stations on the new line of the New York Elevated road.

The Barney & Smith Manufacturing Co., at Dayton, O., has just completed 200 eight-wheel gondolas, to carry 15 tons, for the Cleveland, Tuscarawas Valley & Wheeling road. The works are now delivering three coaches and 65 freight cars to the Denver, South Park & Pacific; four coaches, 50 flat and 50 box cars to the Springfield, Jackson & Pomeroy. They are running on orders for two sleeping and three baggage cars for the St. Paul & Sioux City; seven coaches and four baggage cars for the St. Paul & Pacific; four coaches for the Chicago, Milwaukee & St. Paul, and 250 box cars for the Union Pacific, with propositions out for other passenger and freight work. The company has just added to its blacksmith shop 25 new fires, a 2,000-lbs. steam drop, one 1,000-lbs. and one 350-lbs. steam hammer.

The Pueblo (Col.) Rolling Mill is running on a large order to reroll iron rails for the Missouri, Kansas & Texas road.

The Washburn & Moen Manufacturing Co., at Worcester, Mass., is running its works day and night. The company has very large orders for the steel-wire barb fence, and the works are turning out the great quantity of 160 miles a day, chiefly for railroad companies.

The National Locomotive Works of W. H. Baily & Co., at Connellsville, Pa., recently shipped two narrow-gauge engines to California.

The Allentown (Pa.) Rolling Mill Co. has started up its rail mill on several orders.

The Vulcan Iron Works, a new company, are building a very large foundry at New Britain, Conn.

The Atlantic Rolling Mill, at Sharon, Pa., is running full double turn.

Pine Grove Furnace, at Hanging Rock, O., went into blast a short time since.

Crowther Furnace, at New Castle, Pa., was to go into blast this week.

The Iron-Clad Paint Co., of Cleveland, O., is now putting in the necessary mills, and will soon be ready to furnish iron-clad paint ground in oil. The company has just filled a large order for the Toledo & Wabash Elevator Co., for repainting their elevators, some of which were painted with iron-clad 10 years ago. Shipments have been made this month to the Michigan Car Co., Erie Railway, Chicago, Milwaukee & St. Paul, Utica, Ithaca & Elmira, New Orleans & Mobile, Missouri & Western, Canada Southern, Mobile & Ohio, Indianapolis, Cincinnati & Lafayette, Cincinnati, Hamilton & Dayton, Nashville, Chattanooga & St. Louis, and other large consumers.

The Port Hope Car Works will be sold at public sale by John Mulligan, Assignee, at Port Hope, Ont., June 6. If no bid over $15,000 is received for the whole property, it will be divided into lots.

The Cambria Iron Co. is running East Conemaugh Furnace on Bessemer iron, but will shortly begin to make spiegel there.

Duquesne Forge, at Pittsburgh, recently completed a Bessemer steel shaft for a steamboat at Cincinnati. The shaft is hexagonal, 21 ft. long and 6 in. diameter, and is said to be the first steel shaft forged in Pittsburgh. The steel was made by the Edgar Thomson Works.

The Bochum Iron Works Co., of Westphalia, Prussia have taken a contract to make 13,000 tons of steel rails for the Portuguese Government railroads, delivery to be spread over two and one-half years. The price is about $33 per ton.

The Baldwin Locomotive Works, at Philadelphia, have an order for two mogul freight engines and one passenger engine for the Terre Haute & Indianapolis road.

A dispatch from Pittsburgh, May 28, says: "Kimberly, Carnes & Co., one of the largest iron firms of Western Pennsylvania, with works located at Newcastle, Greenville, Sharon and other points in the Shenandoah Valley, failed to-day. The immediate cause of the failure was the inability to procure discounts, $100,000 worth of their paper having gone to protest on Saturday. The liabilities and assets cannot be ascertained until after the creditors meet, in a few days."

Bridge Notes.

Arms, Bell & Co., of Youngstown, O., have just completed two bridges to go to Kentucky, and are building several others. They are of the design patented by Wm. O. Douglass, of Binghamton, N. Y.

Wm. B. Scaife & Sons, of Pittsburgh, recently shipped an iron roof for the railroad depot at Fernandina, Fla.

The contract for a highway bridge at Miller's Ford, Lebanon County, Pa., was last week awarded to the Weimer Machine Works, of Lebanon.

The American Bridge Co., of Chicago, reports the following work now in progress: Three iron spans, 300 ft. iron viaduct and one Howe truss span for Missouri Extension of Chicago & Alton; five combination and two iron spans for Denver, South Park & Pacific; two iron and three combination spans for Hot Springs road; one iron span for Chicago & Northwestern; two combination spans for St. Louis & San Francisco; iron draw, Osage River, for Missouri Pacific; one combination span for Southern Minnesota; four combination spans for Atchison, Solomon Valley & Denver; three iron spans for Chicago, Milwaukee & St. Paul; iron foundry building and roof for J. H. Bass, Chicago; iron roof and skylight for Singer Manufacturing Co. building, Chicago, and iron viaduct to carry First avenue, Milwaukee, over Chicago, Milwaukee & St. Paul tracks.

Sealed proposals will be received by the trustees of the New York & Brooklyn (East River) Bridge, at their office, No. 21 Water street, Brooklyn, N. Y., until June 15, for the manufacture and delivery—not including erection—of about 5,800 tons of wrought-iron and steel work required for the suspended superstructure of the East River Bridge. Specifications may be obtained and plans seen at the engineer's office.

The contract for a new iron highway bridge over the Mohawk River at Crescent, N. Y., has been awarded to Hutchinson & Shipman, of the New York Bridge Works, for $18,000. The bridge will have 26 spans, of 44 ft. each.

The Phœnixville Bridge Works have been awarded the contract for building a new iron bridge over the Schuylkill River at Reading Pa., for the Lebanon Valley Branch of the Philadelphia & Reading. The bridge will replace the temporary structure in use since the old bridge was burned in the July riots last year.

Notes

There is only one railroad company in the United States, we believe, which considers itself upright enough to go to church. The Boston, Concord & Montreal holds its annual meetings in the Congregational Church at Plymouth, N. H.

A railroad watchman at Creston, the other day, found a pocket book containing $10,000, belonging to a cattle shipper. He returned the money to its owner, who allowed him the generous reward of $1 for his honesty.—*Davenport (Ia.) Gazette.*

The President of one of the Indianapolis roads recently telegraphed to the Superintendent, asking him if he did not, as business was so dull, think the boys would stand another 5 or 10 per cent. cut. The latter answered: "When you made the last cut I discharged most of the single men, and the married men were obliged to drown one child each. Should you make another cut I don't know what the d——l they would do."—*Indianapolis Journal.*

A small boy fell from an Erie emigrant train near Lanesboro one night last week. When his mother got hold of him she took him across her knee and "warmed" him thoroughly. That boy will carry to his grave an unfavorable impression of the men who rescued him.—*Port Jervis Gazette.*

Steam Gauges Clogged.

The Springfield (Mass.) *Republican* of May 28, says: "The liability of steam gauges to get clogged up was recently well illustrated with the Connecticut, Boston & Albany engine. The gauge indicated no pressure though fired up to what was afterward estimated to be 200 pounds to the square inch, when the gauge was found wholly stopped up with sand. The extraordinary pressure started all the seams, so that the boiler had to be heavily caulked, and she is now running without lagging to find further leaks. Engineers say the "Indiana" blow-up was in all probability due to the gauge's getting clogged, thus deceiving the engineer as to the amount of steam on. And to this is laid the later crown-sheet explosion which shattered the cab and cleaned out the tender full of coal as neatly if it had been washed. The engine gauges are now being generally overhauled."

Quick Work in a Boiler Shop.

The Jackson (Mich.) *Patriot* says: "Last Monday John McIntyre, with helpers Richard Whalen, Andrew Connor, G. W. Updyke and C. M. Rutherford, in the Central boiler shops, began on six new boilers to show how fast they could do work in that shop. They flanged the twelve inside fire-box heads, six front and six back, in twenty-two hours and ten minutes, the twenty-four short corners, each requiring a separate heat, being made in two hours ten minutes. They also flanged the six large outside or back-end heads, which had 108 feet of plate, with a nine-inch flange, in twenty-one hours. The steel was Cleveland rolled steel, part half-inch and part three-eighth inch. This job of boiler-building has never been equaled, or if it has, no one seems to have heard of it."

Prices.

Pig iron is lower than it has ever been before since there was any considerable production in this country, and has fallen considerably within a few months. New York quotations at the close of last week were $16.50 to $18 per ton for No. 1 foundry, $15.50 to $17 for No. 2, and $14.50 to $16 fine forge. Steel rails, however, keep up, the mills all being full of orders for months ahead. Quotations were $43 to $44 per ton, which is $4 a ton more than at the beginning of the year. As during the same time the price of pig has fallen off a dollar or more, the profit in making steel rails must have increased materially; and it is said that the works sometimes accept lower than current prices for rails to be rolled next fall. Iron rails are quoted at $32 to $36 in the East, and old rails have been sold recently at $17.50.

OLD AND NEW ROADS.

Atchison, Topeka & Santa Fe.—At the annual meeting in Topeka, Kan., May 16, resolutions were passed expressing the thanks of the company to D. L. Lakin, who has served as a director from the organization of the company, but this year declined reëlection.

At a meeting of the board held the same day resolutions

were passed thanking Hon. Ginery Twichell, who also declined a reëlection as director, for his efficient and honorable services as a director and for a time President of the company.

At another meeting, held May 17, the board passed the following resolutions:

"*Whereas*, The attention of the board having been called to the late strike of a portion of the engineers and firemen of this company;

"*Resolved*, That the thanks of the board are hereby tendered to the General Manager, Superintendent and officers of the company for the firmness and fidelity with which they have maintained the rights of the company in the late strike of a portion of the engineers and firemen.

"*Resolved*, That the special thanks of the board are tendered to the engineers and firemen and other employés who refused to join in the strike, for their fidelity, and that the General Manager be requested to convey to them this approval of their action.

"*Resolved*, That we express hereby our approval of the action of our General Manager as expressed in circular No. 11 of General Superintendent, April 7, 1878.

"*Resolved*, That the thanks of this company be tendered to His Excellency, George T. Anthony, for the promptitude and firmness exhibited by him as Governor, in asserting the power of the State by a fearless enforcement of the laws, to protect the property and rights of this company, to secure the safety of travel and trade over the public highways, and to preserve the peace of the State when, as lately, threatened by lawless persons attempting by force to control the business of this company. He has secured the brilliant future of young Kansas, in this assurance, that within her border force is subject to law, and that all are alike subject to and protected by law."

Atlantic, Mississippi & Ohio.—A circular from the London bondholders' committee says: "The committee are informed by their agent in America that the Court has fixed October next for hearing the petition of the trustees for a final decree for the sale of the property, and also that the Governor of the State of Virginia has instructed the Attorney-General to do what is necessary to carry out the scheme of re-organization proposed by the committee."

Baltimore & Delta.—At a recent meeting of the directors, Chief Engineer Dandridge reported his preliminary survey completed, and that the average cost of grading, masonry and trestle superstructure, per mile, will be $5,000, making for the 45 miles, the distance from Delta to Baltimore, by Long Green, $225,000, to which must be added for bridge superstructure, the sum of $20,000. The report of the agents employed to secure the right of way was of an encouraging character. The Chief Engineer was ordered to commence the location of the road at Baltimore without delay. A committee was appointed to complete the necessary organization in Pennsylvania to cover the short distance from the Maryland line to the Peach Bottom road at Delta.

Bellefontaine & Northwestern.—This company has been organized to build a narrow-gauge road from Bellefontaine, O., northwest by way of Wapakoneta and Van Wert to the Indiana line in Van Wert County. The distance is about 70 miles.

Boston, Concord & Montreal.—This company is having surveys made for a branch from a point near Bethlehem, N. H., southward along the side of Mount Lafayette to the Profile House in the Franconia Notch. The distance is about 10 miles and three miles of this is already covered by a road built some time ago by a lumber company which owns a large tract of woodland near Bethlehem. Besides serving the summer travel to the mountains this branch would give an outlet to a great deal of lumber.

Boston, Hoosac Tunnel & Western.—Troy (N. Y.) papers state that this company has leased the right from the Delaware & Hudson Canal Company to run passenger cars into that company's depot at Albany and into the Union depot in Troy for 20 years, also to use that company's freight yards on Green Island for the same period. A track will be laid from Mechanicville to Troy parallel with the Rensselaer & Saratoga road. The Mechanicville bridge will be ready for use early in July.

Boston & Lowell.—This company was on trial last week at Newburyport, Mass., on an indictment charging it with causing the death of four persons run over by a train on the pier at Salem last August. A number of witnesses testified that the train ran down the pier at a speed of five or six miles an hour, without using bell or whistle, while others swore that both were used and the train was lighted, and the conductor said that he walked ahead of the train with his lantern in hand. The verdict was against the company, but an appeal was taken, on the ground that this verdict was contrary to the weight of evidence.

Cairo & St. Louis.—In the suit brought by this company to compel the issue of the bonds voted by Jackson County, Ill., in aid of the road, the Illinois Circuit Court has decided against the company, holding that the conditions of the subscription have not been complied with. The case will be carried up to the Supreme Court.

The officers of the road are trying to secure a share of the Southern Illinois fruit traffic, not only to St. Louis, but to Chicago. Arrangements have been made with the Chicago & Alton to take fruit from East St. Louis and carry it to Chicago on fast time.

Chicago & Alton.—Contracts are reported let as follows between Marshall, Mo., and Kansas City, on the new Kansas City Extension: Sections 85-95, H. McPherson, Boonville, Mo.; 96-99, Woolley & Boone, Elgin, Ill.; 100-103, W. A. Doomer & Co., Macon, Mo.; 104, F. Liese, Lafayette, Mo.; 105-114, Shelby & Lilly, Lexington, Mo.; 115-126, Reed & Taylor, Marshall, Mo.; 127-130, Hackett & Emberg, St. Louis; 131-132, Lee & Lacy, Keokuk, Ia.; 133-144, Donahue & Shields, Bound Brook, N. J.; 145-146, J. C. Lee, Keokuk, Ia.

In the old suit to require an account from Samuel J. Tilden and L. H. Meyer as trustees, the answer was lately filed in the United States Circuit Court in Chicago. It is long and recites fully Mr. Tilden's connection with the road from the time when it was apparently hopelessly involved and embarrassed up to the present time, and says that for his entire services and expenses for a long period of time as one of the reorganization committee only the sum of $20,000 was received. The answer further sets up as rebutting all frauds that the money and all securities under the control of trustees are at the United States Trust Company, New York, of which John A. Stewart, one of the directors of the railroad company, is President.

Chicago & Illinois River.—On petition of holders of second-mortgage bonds, the United States Circuit Court in Chicago has decided to issue a temporary injunction, restraining the sale of this road under foreclosure of the first mortgage, until the intervening petition can be heard on its merits.

Colorado Central.—The extention of the narrow-gauge line from Black Hawk, Col., to Central City, 4¼ miles, has been completed and opened for business, making this branch of the road 25½ miles long, from Golden to Central. This extension has been in progress for some time, requiring very difficult and expensive work in the narrow and rocky cañon through which it passes. The new line has some very abrupt curves, the sharpest being 179 ft. radius, while the heaviest grade is 179.5 feet to the mile. Central City is an important mining town.

Columbus & Bellefontaine.—This company has been organized to build a narrow-gauge road from Columbus, O., west by north to Bellefontaine, about 50 miles. From Bellefontaine to Marysville, 22 miles, there is an old graded roadbed, which can be used. Arrangements are being made to begin work very soon.

Connecticut Central.—Last winter this company procured from the Connecticut Legislature a special act, authorizing it to make connections with any railroad which it may cross or join, and requiring such road to receive passengers or freight and cars and to exchange business. Any difference as to terms is to be settled by a reference to the Railroad Commissioners, but an appeal from their decision is allowed to be taken to the Superior Court.

Connecticut Western.—It is said that the mortgage on this road has been found defective in not having been executed before two witnesses, as required by law. The discovery was accidental, and there is no intention of questioning its validity on account of this technical defect. Application will be made to the Legislature for a special act validating the mortgage.

Denver & Rio Grande.—The report of the Treasurer, Mr. R. F. Weitbrec, gives the following figures for April and the four months ending April 30:

	April.	Four months.
Freight	$57,295.49	$184,510.03
Passengers, mail and express	23,275.90	74,786.87
Miscellaneous	201.15	967.00
Total	$80,772.54	$260,263.90
Expenses	46,868.07	169,256.18
Net earnings	$33,904.47	$91,007.72
Earnings per mile	265.70	856.13
Per cent. of expenses	58.02	65.10

Earnings on mail and other Government business in April were $4,134.85. For April there was an increase of $31,449.37, or 63.8 per cent., in gross, and of $11,940.48, or 54.3 per cent., in net earnings. For the four months the gross earnings increased 44.1 per cent., and the net earnings 17 per cent.

Fort Dodge & Fort Ridgeley.—Track is reported laid on this road from Fort Dodge, Ia., northward to Humboldt, 16 miles. Tracklaying was begun in November last, and some 12 miles of the road were laid in 1877.

Griffin, Monticello & Madison.—The present owners of this partly-graded road have, it is said, secured iron enough to lay the track from Griffin, Ga., eastward, 20 miles to Indian Springs in Butt County. Work will soon be begun, getting out ties and repairing the old grade.

Indianapolis, Bloomington & Western.—Receiver Wright's April report is as follows:

Balance, April 1	$43,887.59
Receipts	162,242.33
Total	$206,129.92
Disbursements	138,563.17
Balance, May 1	$67,566.75

The receipts were $23,679.16 greater than the disbursements.

Keokuk & Des Moines.—A circular from the board, after giving notice of the annual meeting to be held June 6, for the election of three directors, says:

"It is proposed to elect Mr. David Dows, the Vice-President of the Chicago, Rock Island & Pacific Railroad, as one of the three directors to be chosen at said meeting.

"The board of directors of this company have ratified a contract for the lease of its road equipment and other appurtenances in the State of Iowa, to the Chicago, Rock Island & Pacific Railroad Company, for the period of 45 years, or to the termination of its charter, with an engagement to turn over to the lessees a controlling number of the shares of the preferred and common capital stock, to be paid for by said lessees at the rate of one dollar per share for the preferred stock and 50 cents per share for the common stock, the further object being to make the balance of the stock more valuable by reason of the association with said lessees. The other terms of the lease are mainly these:

"All outstanding bonds scrip and past due coupons of this company, are to be retired through the Farmers' Loan & Trust Company, of New York, and a new mortgage will be made covering all the property of the company in the State of Iowa, and which will be a first and only lien on the same when the mortgages securing the above issues are canceled. The new bonds, amounting in the aggregate to $2,750,000, will date from Oct. 1, 1878, and bear interest at 5 per cent. per annum, and mature Oct. 1, 1923. The interest to be specifically guaranteed and indorsed upon the bond by the lessees and paid by coupons semi-annually in this city [New York]. A certain percentage of the gross earnings of our road is to be set apart annually, and the surplus thereof, after payment of the interest on the bonds, will be distributed among the stockholders, according to their respective rights. The stockholders will be required to surrender for conveyance to the lessees, as herein first stated, 40 per cent. of their respective holdings of preferred stock, and 60 per cent. of their respective holdings of common stock.

"The contract of lease must be ratified at the annual meeting to be held according to this notice, June 6, 1878, by a majority of the stockholders and voting bondholders, and it is extremely important that all such holders who cannot be present personally at said meeting at Keokuk, Iowa, should send their proxies without delay, and as per blank inclosed herewith, to the office of this company. Further particulars of the lease may be had by personal application at this office."

Lehigh & Lackawanna.—Track is reported laid on the extension of this road from the late terminus at Chapman, Pa., northeast to the Wind Gap, 10 miles. From the Wind Gap to Stroudsburg, 10 miles further, the work is well advanced, and it is expected that trains will through by July 4.

Logansport, Crawfordsville & Southwestern.—Receiver Claybrook reports for April as follows:

Balance, April 1	$9,421.14
Receipts	20,673.22
Total	$30,094.36
Disbursements	22,485.68
Balance, May 1	$7,608.68

The disbursements were $1,812.46 greater than the receipts.

Montclair & Greenwood Lake.—Notice is given that, under an order of the Court of Chancery of New Jersey, all creditors of this company must prove their claims before Hon. G. A. Hobart, Receiver, within four months from May 20. Failing to do so, they will be barred from the benefits of any dividends which may hereafter be declared from the estate of the bankrupt corporation.

Morgan's Louisiana & Texas.—This company has ordered 3,000 tons of steel rails and 35,000 ties for the extension of the road from Morgan City, La., westward toward the Sabine River.

Nashville, Chattanooga & St. Louis.—This company's statement for the ten months of its fiscal year ending April 30 is as follows:

	1877-78.	1876-77.	Increase.	P.c.
Gross earnings	$1,543,519	$1,386,190	$157,329	11.3
Expenses	926,894	850,873	76,021	8.9
Net earnings	$616,625	$535,317	$81,308	15.2
Interest on bonds	365,100	365,100	.....	....
Surplus	$251,525	$170,217	$81,308	47.8

The expenses were 60.05 per cent. of earnings this year, against 61.39 per cent. last year. Taxes paid are included in expenses.

The Augusta (Ga.) *Chronicle* says: "A portion of the assets of the Georgia Railroad & Banking Company has consisted of 18,000 shares of the Nashville, Chattanooga & St. Louis Railway Company of the par value of $25 per share. This stock was originally one-third of that amount, but the declaration of stock dividends brought it up to the figures above given. We learn that a few days since this stock was sold to Col. E. W. Cole, President of the Nashville, Chattanooga & St. Louis Railroad for $119,500."

New Hampshire Railroad Projects.—Notice has been given of an application to the Legislature for a charter for a narrow-gauge road from the Boston, Concord & Montreal at Littleton or Bethlehem to the Profile House in the White Mountains.

Another application will be made for a charter for a railroad from the Grand Trunk at North Stratford, N. H., northward through the towns of Columbia and Colebrook to the Canada line near Canaan, Vt. The distance is about 20 miles.

Northern Pacific.—The St. Paul *Pioneer-Press* says: "Mr. James Dilworth, one of the leading directors of the Northern Pacific Railroad, has been making a trip westward with some friends over that line of road, and has been investigating the working of the road. Mr. Dilworth was very much dissatisfied with the operation of the running arrangements of the Northern Pacific with the St. Paul & Pacific from Sauk Rapids to St. Paul, and found a good deal of complaint that these arrangements were oppressive to the Northern Pacific, the grounds of which he inquired into. He was so well satisfied that the roads could not operate in harmony, and that the terms for running over the branch line were too onerous, that he stated his determination at the next meeting of the directors to urge the construction of a new railroad from Sauk Rapids to St. Paul on the westside of the river, crossing the river at St. Cloud and running through Wright and Hennepin counties via Minneapolis. It is said that the people on that side of the river are very anxious to secure a road, and will give substantial aid to the project."

Nova Scotia, Nictaux & Atlantic Central.—Work has been suspended on this road. The reason given is that the company has asked some additional concessions as to the subsidy which the Nova Scotia Government is not willing to grant.

Ohio & Mississippi.—A Cincinnati dispatch of May 22 says: "The directors of the Ohio & Mississippi Railway Company at a special meeting held for the purpose, to-day, adopted, unanimously, the recommendation of the committee looking to the relief of the company from the floating debt and other obligations, and its restoration to the hands of the stockholders. It is confidently believed that the prospect for good crops along the line of this road, the large increase of its local business and the economy of its present management with its improved condition, much of the line laid with steel rail, will lead to much better results than ever before in the history of the road, and, in addition, a large increase in through tonnage is looked for. A gratifying exhibit was made of the net earnings since Jan. 1, being considerably in excess of the receipts for the same period last year. President Parsons, Messrs. W. W. Scarborough, Robert Garrett, W. T. McClintick and H. M. Day were appointed a committee to carry out the views of the Board."

Pennsylvania.—The April statement for all lines east of Pittsburgh and Erie shows for the month:

Increase in gross earnings	$163,101
Decrease in expenses	132,640
Net increase	$295,741

For the four months ending April 30, as compared with the same period in 1877, the same lines show:

Increase in gross earnings	$261,523
Decrease in expenses	299,944
Net increase	$561,467

The lines west of Pittsburgh also show a fair increase this year.

Portland & Ogdensburg.—It is said that this company desires to build this year a line of its own from Fabyan's to Dalton, N. H., where it now uses the Boston, Concord & Montreal track, and that it will once more ask the Legislature to relieve it from the obligation of building through the town of Littleton, as required by its charter.

Potomac, Fredericksburg & Piedmont.—A circular from this company announces that on May 13 it resumed sole control of the railroad recently operated by the Royal Land Company. Its general offices will be at Fredericksburg, Va.

This road was originally the Fredericksburg & Gordonsville, and track was laid upon it from Fredericksburg west 18 miles, several years ago, but not operated. In 1876 the Royal Land Company acquired possession, changed the gauge to three feet, and extended it to Orange Court House, making it 38 miles long. The reasons for the present transfer are not stated.

Reading & Lehigh.—In view of the proceedings begun to foreclose the mortgage on this road the stockholders recently held an informal meeting, and decided to combine and buy in the road in case of a sale, in order to prevent its purchase by the Philadelphia & Reading, which now leases it.

St. Louis & Southeastern.—Auditor Young's report for the month of April is as follows:

	St. Louis Div.	Ky. Div.	Tenn Div.	Entire Line.
Gross earnings	$48,130.47	$26,636.49	$13,173.37	$87,940.33
Expenses	38,956.53	22,632.52	9,997.34	71,586.39
Net earnings	$9,173.94	$4,003.97	$3,176.03	$16,353.94
P. c. of expens.	81.16	85.18	75.74	81.44

Compared with April, 1877, the entire line shows an increase of $12,428.28, or 16.5 per cent., in gross earnings, and of $4,959.78, or 43.5 per cent., in net earnings.

St. Louis, Iron Mountain & Southern.—The new and extensive repair shops at De Soto, Mo., are finished, and their opening was celebrated May 23 by a procession and speeches, followed by a public ball.

Scioto Valley.—This company is now offering its first-mortgage 7 per cent. bonds for sale in New York at 85. The total issue authorized is $1,250,000 on the completed line of 100 miles, from Columbus, O., to Portsmouth.

Toledo & Ann Arbor.—This company has completed an agreement of consolidation with the Toledo & State Line, a company organized for the purpose of building the road from the Michigan State line to Toledo, about six miles. The necessary articles of consolidation have been filed; the capital stock of the consolidated Toledo & Ann Arbor company is $450,000.

The track is now all laid from Toledo, O., a little west of north to Ann Arbor, 46 miles, of which six miles are in Ohio and 40 in Michigan. The road was originally the Toledo, Ann Arbor & Northern, and a large part of it was graded several years ago. Work was stopped and the property was finally sold at sheriff's sale to the present owners, who have completed it as a narrow-gauge road. Four engines have been purchased, and regular trains are to be put on the road early in June. It passes through a section of country of which no part is more than eight or ten miles from some existing road, and it will be entirely dependent upon the local business.

Viroqua.—This company has filed articles of incorporation in Wisconsin to build a railroad about 35 miles long, from Viroqua, Monroe County, Wis., northward to Sparta on the Chicago, Milwaukee & St. Paul. The capital stock is to be $400,000.

Wabash.—Additional litigation is reported, holders of Toledo & Wabash second mortgage and Wabash & Western second mortgage bonds having notified the trustees to begin proceedings in foreclosure. The same action has been taken by a holder of Decatur & East Louis first-mortgage bonds, but the trustees have taken no steps as yet.

Wabash & Erie Canal.—In the matter of the sale of this canal the United States Court has approved the report of the Master in the case, and directed him to retain $15,000 as a fund to meet certain claims, and to pay out the balance of $61,038.13 in his hands as a dividend to the bondholders, being about 8.4 per cent. of the principal.

West River Valley.—Sufficient subscriptions have been secured to warrant the beginning of the work, and a survey is to be made of the line from Brattleboro, Vt., to Londonderry.

ANNUAL REPORTS.

Boston, Concord & Montreal.

This company owns a line from Concord, N. H., north by west to Woodville (Wells River) and thence northeast to the Grand Trunk at Groveton Junction, 145 miles, with a branch from Wing Road by Fabyan to Mount Washington, 22 miles, 167 miles in all. Its 32d annual report covers the year ending March 31, 1878.

The equipment consists of 30 engines; 25 passenger, 2 drawing-room and 15 mail and baggage cars, and 580 freight cars.

The general account is as follows:

Stock ($10,778 per mile)		$1,800,000.00
Bonds ($15,138 per mile)		2,528,000.00
Coupons and dividends unclaimed		20,935.89
Profit and loss		582,413.94
Total ($29,529 per mile)		$4,931,349.83
Road and extensions ($25,862 per mile)	$4,319,000.00	
Fuel, materials, Superintendent's balance	162,991.81	
Trustees of sinking fund	201,500.00	
Pemigewassett House	16,000.00	
Cash for coupons, bonds, etc.	20,287.00	
Cash and bonds on hand	211,571.02	
		4,931,349.83

The bond statement above includes $624,000 sinking-fund bonds, of which $422,000 are held by the company or the trustees and draw no interest; $333,000 have been temporarily replaced by notes, which are to be retired through the sale of consolidated bonds. The stock consists of $800,000 preferred, $459,600 old and $540,400 new stock. The attempt to consolidate it in one class has not been successful as yet, owing to the unwillingness of some holders to exchange and the difficulty of finding others.

The earnings for the year were as follows:

	1877–78.	1876–77.	Inc. or Dec.	P. c.
Passengers	$257,405.42	$250,295.36	I. $7,170.06	2.9
Freight	307,270.42	370,849.70	D. 3,579.28	1.0
Mail, express, etc.	29,536.36	28,162.75	I. 1,373.61	3.9
Total	$654,272.20	$649,307.81	I. $4,964.39	0.8
Expenses	453,171.84	457,377.44	D. 4,205.60	0.9
Net earnings	$201,100.36	$191,930.37	I. $9,169.99	4.8
Gross earn. per mile	3,917.80	3,935.20	D. 17.40	0.4
Net " "	1,204.19	1,163.21	I. 40.98	3.5
Per cent. of expenses.	69.26	70.44	D. 1.18	1.7

The work done for the year was as follows:

Train mileage:	1877–78.	1876–77.	Inc. or Dec.	P.c.
Passenger	361,424	372,609	D. 11,185	3.0
Freight	329,542	310,125	I. 19,417	6.3
Service	11,714	20,751	D. 9,037	42.3
Total	702,680	703,485	D. 805	0.1
Passengers carried	220,003	211,689	I. 8,314	3.9
Passenger mileage	6,590,094	7,499,539	D. 909,445	12.1
Tons freight carried	152,929	126,434	I. 26,495	21.0
Tonnage mileage	7,800,604	7,586,019	I. 214,595	2.8
Average train load:				
Passengers, number	18.24	20.13	D. 1.90	9.4
Freight, tons	23.67	24.46	D. 0.79	3.2

The traffic last year was equivalent to 54 passengers and 64 tons of freight carried each way daily over the whole length of road. The local business furnished 145,399 passengers and 22,919 tons of freight.

The income account was as follows:

Bonds and cash on hand from last report		$169,518.70
Net income		201,100.36
Interest received		17,883.01
Bonds (consolidated) sold		91,000.00
Decrease in balances		38,956.12
Total		$518,458.19
Coupons and interest paid	$145,749.39	
Preferred stock dividends	46,971.00	
Mt. Washington Branch	91,000.00	
Increase in fuel and supplies	3,679.78	
		287,400.17
Bond and cash on hand, April 1		$231,058.02

Showing a net gain of $26,262.98. During the year 600 tons of new rails were laid and 573 tons repaired and relaid; 84,887 new ties were put down and 60,000 yards of ballasting used. One engine was bought and 16 freight cars rebuilt.

The old contract with the Southeastern and Passumpsic companies has been closed and settled up, and a new contract made for 10 years from May 1. New contracts have been made with the Concord and the Boston & Lowell companies, which are as satisfactory as could be expected. Relations with the Portland & Ogdensburg are good and that company makes prompt monthly settlements for trackage due.

The report notices appropriately the death of Mr. John E. Lyon, for many years President of the company.

Georgia.

This company owns a line from Augusta, Ga., to Atlanta, 171 miles; a branch from Barnett to Washington, 18 miles; a branch from Union Point to Athens, 39 miles, and a branch from Camak to Warrenton, 3 miles, making 231 miles in all. It controls and works the Macon and Augusta road, from Warrenton to Macon, 75 miles, but its accounts are stated separately. The report is for the year ending March 31.

The equipment owned is 49 engines; 27 passenger, 2 sleeping and 13 baggage and mail cars; 517 box, 34 stock, 57 coal, 112 platform and 26 caboose cars; 1 pay, 2 wood and 21 shanty cars. One engine was broken up and two more bought during the year.

The Cashier's statement (condensed) is as follows:

Stock ($18,182 per mile)		$4,200,000.00
Profit and loss		919,626.95
Income of road	$1,148,053.77	
Interest on investments	54,968.75	
		1,203,022.52
Bond redemption account		211,063.78
Company's bonds ($3,989 per mile)		921,500.00
Dividends unclaimed		34,033.28
Macon & Augusta R. R.		71,000.00
Bank notes and change bills		77,673.43
Total		$7,637,919.96
Road and real estate ($18,674 per mile)	$4,313,593.18	
Material	46,770.25	
Road expenses	833,431.05	
Interest and legal expenses	65,037.43	
Stocks and bonds owned	1,281,321.15	
Western R. R. of Alabama, purchase	361,005.81	
Coupon accounts, guaranteed bonds	550,916.04	
Cash, bills receivable, etc	185,845.05	
		7,637,919.96

The bonds outstanding were increased $391,500, the proceeds being used in purchase of Port Royal bonds indorsed by the company, of which $397,000 are now held.

The earnings for the year were as follows:

	1877–'78.	1876–'77.	Inc. or Dec.	P. C.
Passage	$191,896.15	$194,280.76	D. $2,384.61	1.2
Freight	793,151.54	919,641.88	D. 126,490.34	13.8
Mails	28,664.92	29,205.60	D. 540.68	1.9
Total	$1,013,712.61	$1,143,128.24	D. $129,415.63	11.3
Expenses	727,700.45	643,110.30	I. 84,590.15	13.2
Net earnings	$286,012.16	$500,017.94	D. $214,005.78	42.8
Gross earnings per mile	4,388.37	4,048.61	D. 560.24	11.3
Net earnings per mile	1,238.15	2,164.58	D. 926.41	42.8
Per ct. of exps.	71.50	56.26	I. 15.24	27.1

Expenses were increased by accidental damages and by unusual expenditures for steel rails. Business suffered by diversion of traffic to Savannah, which had been driven away from that city by the yellow fever the year before, and especially by the opening of the Northeastern road to Athens, which has not only taken away business but has reduced rates on a large local traffic, which formerly went entirely to the Georgia road. Some statements of traffic are as follows:

	1877–78.	1876–77.	Decrease.	P. c.
Engine mileage	1,147,383	1,162,300	14,917	1.3
Bales cotton carried	220,540	272,602	52,062	19.1
Bushels grain	1,480,505	1,607,529	187,024	11.2
Barrels flour	122,034	149,460	27,426	18.3
Tons fertilizers	36,190	37,708	1,538	4.1

Superintendent Johnson in his report urges the need of a larger traffic and believes that efforts should be made to secure a larger through business from the West.

There were used in renewals 704 tons of iron and 1,998 tons of steel rails and 87,590 new ties. The road is in good condition. Much attention has been given to the water supply, and some changes have been made by which it has been much improved. A trial made with wire fence has proved successful.

President King's report is chiefly taken up by a defense of the Port Royal guarantee. The company now owns or controls nearly all the guaranteed bonds.

MACON & AUGUSTA.

The earnings for the year were as follows:

	1877–78	1876–77.	Inc. or Dec.	P. c.
Freight	$67,097.78	$90 085.50	D. $22,987.72	25.3
Passengers	28,004.78	21,693.91	I. 6,310.87	29.1
Mails	4,085.24	3,950.04	I. 135.20	3.4
Total	$99,787.80	$116,329.45	D. $16,541.65	14.2
Expenses	104,607.96	98,040.15	I. 6,567.81	6.7
Deficit or net	$4,820.16	$18,289.30		
Gross earn. per m.	1,330.51	1,551.06	D. $220.55	14.2
Net " "		243.86		
Per cent. of exps.	104.83	84.28	I. 20.55	24.4

The loss in earnings was chiefly from diversion of business to Savannah. The expenses were increased by heavy renewals of bridges and trestles, which had to be made.

Utica & Black River.

This company owns a line from Utica, N. Y., northward to Philadelphia, 87 miles. It leases the Philadelphia & Morristown road, which extends the main line northward to Morristown, on the St. Lawrence, 37 miles; the Carthage, Watertown & Sackett's Harbor, a branch from Carthage to Sackett's Harbor, 30 miles, and the Clayton & Theresa, a branch from Theresa to Clayton, 16 miles, making 170 miles in all. An extension from Morristown to Ogdensburg, 10 miles, is now being built.

The equipment owned consists of 18 locomotives, 19 passenger and 9 baggage cars and 210 freight cars.

At the close of the last fiscal year, Sept. 30, 1877, the general balance sheet was as follows:

Stock ($20,365 per mile)		$1,771,720.00
Bonds ($12,872 per mile)		1,112,000.00
Sundry accounts		57,605.50
Surplus fund		128,228.08
Total ($35,282 per mile)		$3,069,553.58
Road and equipment ($31,968 per mile)	$2,781,178.38	
Leased lines, securities and advances	250,086.59	
Accounts and balances	5,972.27	
Cash	32,316.34	
		3,069,553.58

The rental paid for the Clayton & Theresa and the Black River & Morristown is the interest on the bonds; for the Carthage, Watertown & Sackett's Harbor, 37½ per cent. of the earnings. The Black River & Morristown road cost $561,464.98, of which $500,000 has been repaid by issue of bonds.

The work done was as follows:

Train mileage:	1876–77.	1875–76.	Inc. or Dec.	P.c.
Passenger	230,533	260,508	D. 29,975	11.5
Freight	109,941	94,236	I. 15,705	16.7
Total	340,474	354,744	D. 14,270	4.0
Passengers carried	221,588	245,715	D. 24,127	9.8
Passenger mileage	5,336,245	5,792,703	D. 456,458	7.9
Tons freight carried	100,777	104,698	D. 3,921	3.7
Tonnage mileage	5,085,167	5,150,374	D. 85,207	1.7
Average train load:				
Passengers, No	23.15	22.30	I. 0.85	4.0
Freight, tons	46.07	54.65	D. 8.58	15.7

This traffic was equivalent to 43 passengers and 41 tons of freight carried each way daily over the whole length of road. There was a decrease in local and an increase in through and pleasure travel. The loss of tonnage was in merchandise and manufactured articles.

The earnings for the year were as follows:

	1876–77.	1875–76.	Inc. or Dec.	P. c.
Passengers	$185,109.03			
Freight	246,750.50			
Other sources	21,717.34			
Total	$453,576.87	$481,673.31	D. $28,096.44	5.8
Expenses	233,566.02	287,968.95	D. 54,402.93	18.9
Net earnings	$220,010.85	$193,704.36	I. $26,306.49	13.6
Gross earn per mile	2,668.10	2,901.65	D. 233.55	8.1
Net " "	1,294.18	1,166.89	I. 127.29	10.9
Per cent. of exps	51.50	59.78	D. 8 28	13.9

The average mileage worked in 1875–76 was 166 miles.

The income account is as follows:

Net earnings		$220.010.85
Rents, interest, insurance, etc		13,777.43
Balance from previous year		148,811.36
Total		$382,599.64
Interest on bonds	$77,840.00	
Rentals	65,088.47	
Interest, etc	4,032.59	
Dividends, 6 per cent	106,248.00	
		254,109.06
Balance to new account		$128,490.58

The dividends paid exceeded the amount earned during the year, but were really fully earned, as they covered a period of 14 months. The decrease in expenses was partly apparent only, owing to heavy purchases of fuel in 1876 for future use. The road has suffered from general depression of business, from competition and from the prostration of the lumber trade. An improvement is looked for from the extension to Ogdensburg, which will complete the work of extension and new construction.

Keokuk & Des Moines.

This company owns a line from Keokuk, Ia., northwest to Des Moines, 161 miles. It was formerly part of the Des Moines Valley road, and was acquired by the present owners through foreclosure of mortgage. The latest report is for the year ending March 31, 1878.

The equipment consists of 18 locomotives, 10 passenger, 2 sleeping, 2 combination, 1 smoking and 5 baggage and mail cars; 202 box, 100 stock, 84 coal, 48 flat and 10 way cars; 3 tool, 2 boarding, 1 wrecking, 1 pile-driver and 68 other service cars. Two passenger, 2 combination and 1 baggage and mail car were bought during the year.

The liabilities and assets are as follows:

Common stock		$2,400,000.00
Preferred stock		1,524,600.00
Total stock ($24,376 per mile)		$3,924,600.00
Bonds ($16,645 per mile)		2,679,869.00
Bills payable, accounts and balances		144,048.46
Coupons not funded		20,531.00
Total ($42,044 per mile)		$6,769,048.46
Road and equipment ($40,168 per mile)	$6,467,090.46	
Reserve account, first-mortgage bonds	220,000.00	
Cash, materials, balances due	81,958.00	
		6,769,048.46

There was $112,740.80 added to construction account chiefly for the new bridge and station at Des Moines and for renewals of track. The funded debt was increased $145,600 by funding the coupons due Oct. 1, 1877 and April 1, 1878, with some past due coupons. No bonds have been sold, but $101,000 of those in the reserve are pledged as security for $50,500 bills payable.

The earnings for the year were as follows:

	1877–78.	1876–77.	Inc. or Dec.	P. c.
Passenger	$182,653.68	$186,558.15	D. $3,904.47	2.1
Freight	350,651.21	354,035.76	D. 3,384.55	1.0
Express and mails	24,866.27	24,891.85	D. 25.58	0.1
Trackage, etc	18,070.62	16,513.67	I. 1,556.95	9.4
Total	$576,241.78	$581,999.43	D. $5,757.65	1.0
Expenses	429,072.26	411,556.16	I. 17,516.10	4.3
Net earnings	$147,169.52	$170,443.27	D. $23,273.75	13.7
Gross earnings per mile	3,579.14	3,614.90	D. 35.76	1.0
Net earnings per mile	914.10	1,058.65	D. 144.55	13.7
Per cent. of expenses	74.46	70.70	I. 3.76	5.3

The net earnings were about 5½ per cent. on the funded debt. There was a considerable loss in passenger business, and freight failed to revive, owing to the partial loss of the corn crop. Expenses were increased by heavy repairs to equipment and by an accident causing loss of equipment and other damages.

The work done was as follows:

Train mileage:	1877–78.	1876–77.	Inc. or Dec.	P.c.
Passenger	207,572	203,374	I. 4,198	2.1
Freight	195,179	187,447	I. 7,732	4.1
Total	402,751	390,821	I. 11,930	3.1
Locomotive mileage	603,725	615,322	D. 11,597	1.9
Passengers carried	167,186	194,240	D. 27,054	13.9
Passenger mileage	5,783,938	6,473,169	D. 689,231	10.6
Tons freight carried	200,510	196,756	I. 3,754	1.9
Tonnage mileage	16,491,129	15,874,149	I. 616,980	3.9
Average train load:				
Passengers, No	27.86	31.83	D. 3.97	12.5
Freight, tons	84.48	84.71	D. 0.23	0.3
Average receipt:				
Per passenger per mile	3.10 cts.	2.83 cts.	I. 0.27 ct.	9.5
Per ton per mile	2.12 "	2.23 "	D. 0.11 "	4.9

The traffic was equivalent to 49 passengers and 140 tons of freight carried each way daily over the whole length of the road. The chief items of freight were grain, lumber, coal and ice.

The company was unable, on account of the small net earnings, to resume payment of interest as hoped for. Some improvement may be looked for this year from the repeal of the law regulating freight rates in Iowa. The assessment on the road has also been reduced so that there will be a saving in taxes paid.

During the year 1,005 new steel rails and 49,830 ties were laid. Extensive repairs were made to buildings and fences, and the equipment much improved.

The board recommends the ratification of the lease of the road to the Chicago, Rock Island & Pacific. As noted elsewhere, the lease provides for the transfer of a controlling interest in the stock to the lessee, and the funding all the debt in new consolidated bonds.